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BACK TO TULL.

Peradeniya, September 15, 1913.

In the August issue of the *Tropical Agriculturist* we reproduced part of a paper on the subject of a rainless wheat contributed to the *Nineteenth Century and After* by Dr. MacDonald of the Union Department of Agriculture, one of the foremost exponents of the principles of Dry Farming. In it he referred to Jethro Tull the father of modern farming. Like the navigator of a ship who finds it necessary to fix his position from day to day by direct observations for latitude and longitude, knowing that, however accurately his course may have been steered, he is certain to have deviated from the true direction through the influence of wind and current, so we as planters would do well if from time to time we took stock of our position and endeavoured to ascertain whether we are keeping to established highways or are likely to lose ourselves in some bye-way. Tull said: "Tillage is manure." Tillage we suppose comprehends all operations connected with improving the condition of the soil including manuring, yet so much is often made of manuring trees that there would seem to be a danger of Tull's dictum being rendered as "Manure is Tillage."

One of the most significant discoveries Tull made was that of the advantage of giving plants room. He sowed in drills or rows instead of broadcast. Modern farming has developed this system till at the present day turnips for example are not only sown in drills 2 feet apart but afterwards cross-hoed to leave the plants in the drills a foot apart; each plant being thus given ample room to develop its powers of absorbing food.

It is this important matter of developing the plant's powers that we appear to be in danger of overlooking. A man in the enjoyment of plenty of fresh air, of exercise and healthy surroundings but living on plain wholesome food will grow stronger than another who is confined in a dark ill-ventilated room and fed with the richest food we can give him; a good digestion being of more importance than quality of food. It is well known that in the case of crops that are not thinned out, like wheat for example, you will but reduce your yield by too thick sowing.

A belief prevails that the science of manuring consists of returning to the soil the ingredients removed by the products of the tree; a plausible belief though we are not aware upon what grounds it rests. It would indeed be a satisfaction if the science could be expressed by this simple formula. It is asserted again that the soil should first be analysed to find out in what manurial ingredients it is deficient. But whatever importance may attach to soil analysis in the tropics as a guide as to what plant food to apply, we believe it to be small compared to that of having robust and well developed trees. In the application of manures as in all other branches of estate management our aim should be to get the best return for money expended. We may be sure that the principles of spacing so nicely worked out in the case of the annual crops of the temperate farmer are of paramount importance to us also. A given quantity of manure applied to a vigorous tree would, we may believe, give us a better return than the same quantity applied to a tree stunted in growth through want of room to develop. Our first duty should be to the tree—to ensure that every opportunity is given it of developing to the full its powers of collecting and assimilating food.

R. N. L.

RUBBER.

TAPPING EXPERIMENTS ON HEVEA.

FITTING'S paper on the physiological effects of Hevea tapping methods, which was published in 1909, is well known to the majority of rubber planters, through the translation issued by the *Times of Ceylon*. His work has been followed up by Dr. S. V. Simon who has recently been engaged for nine months in Java on the study of rubber tapping, and other subjects, and has published his results in a series of papers in *Der Tropenpflanzer*. Dr. Simon's paper on rubber tapping, entitled "Tapping Experiments on *Hevea brasiliensis*, with special reference to latex production, bark renewal and the distribution of reserve food," deals chiefly with the much-debated question of the knife *vs.* the pricker. To a great extent, the points elaborated by the author have previously been enunciated by other writers, though his contribution is valuable in that it affords confirmation of their contentions. In the following abstract the notes enclosed in brackets have been added by the translator :—

KNIFE *vs.* THE PRICKER.

Dr. Simon experimented on twelve trees, $5\frac{1}{2}$ years old. Each tree was tapped on both sides—on the one side with the Bowman knife, and on the other with the knife and pricker. Four trees were so tapped, full-herring bone, two vertical strips of cortex from 1 to 2 inches wide being left untapped between the tapping surfaces on the opposite sides of the tree. Four others were similarly tapped, as far as extent of tapping surface was concerned, but with the half-herring bone. The remaining four were tapped on opposite quarters, on one quarter with the knife and on the opposite quarter with the knife and pricker. The average circumference of the trees at three feet was 20 inches, and each tapping surface bore four cuts at a foot apart The trees were tapped every other day for six or, in some cases, seven months.

At the beginning of the experiment, the pricked side yielded more rubber than the other. The former gave a full yield immediately, while in the latter from four to six days elapsed before the yield rose to the maximum. At the end of the first month the advantage lay with the pricked side, but during the second or, in some cases, the third month, this advantage disappeared and the yields of the two sides became practically identical. The total yield for the twelve trees for eight months was 1,979 grams from the sides pricked, and 2,009 grams from the sides not pricked. Taking the individual trees, six yielded more rubber from the pricked side, while in the remaining six the result was the reverse. If the yields of the first eight tappings were omitted, then in no case did the pricked side give the greater yield. Dr. Simon considers that his results demonstrate that pricking does not give a higher yield than paring, and he suggests that opinions to the contrary have been based on the results of too few tappings.

STRUCTURE OF THE CORTEX.

DR. SIMON'S account of the structure of Hevea cortex agrees with that given by Arens, Lock, and others. The latex tubes occur in layers in the cortex, each layer being continuous round the tree, so that if a layer of latex tubes could be dissected away from the cortex, it would form a hollow cylinder, perforated with vertical, oval openings. [A cylinder of wire netting of very small mesh gives some representation of a single layer of latex tubes; and a correct idea of the whole latex system of the stem may best be formed by imagining a number of such cylinders standing one inside the other, the wood of the stem occupying the centre.]

The latex tubes of a single cylinder communicate in the freest possible manner with one another, but there is no communication between the latex tubes of one cylinder and those of the next. Hence it follows that the deeper the cut the more latex: it is impossible to extract latex from any layer of latex tubes unless that layer is reached by the tapping cut. The trees tapped by Dr. Simon contained six layers, or cylinders, of latex tubes, five of which were cut when using the knife, the innermost cylinder being left intact. Therefore the yield obtained by using the knife only was five-sixths of the total possible, and by using the pricker to reach the innermost layer the maximum increase obtainable would be one-fifth of the previous yield. Dr. Simon concludes that his failure to obtain that increase is due to the fact that the penetration of the teeth of the pricker soon produces an injurious effect on the innermost latex cylinder, as is shown by the death of the tissues round the pricker cuts. [It is doubtful whether the explanation is so simple as this. The expected increase is more than one-fifth, because the inner layer of tubes is intact under both tapping surfaces. Each tapping surface, when tapped with the knife, draws on five-sixths of the latex tubes over half the tree, i. e., five-twelfths of the total latex tubes, while the pricker taps the remaining sixth and should draw latex from more than half the circumference. And if the lack of this increase is to be attributed to the effect of the pricker, that effect must be produced on the cortex which has not yet been tapped.]

The trees tapped by the full-herring bone and the half-herring bone were tapped over almost the whole of the circumference at the same time, only two narrow strips of cortex being left untouched between the opposed tapping surfaces. On the other hand, the trees tapped on opposite quarters were tapped over only one half the circumference. Yet the average daily yields of each group of trees were almost the same, although the cuts in the first two cases were nearly twice as long as those in the third. In the full-herring bone, the average daily yield was 3·35 grams per tree; in the half-herring bone, 3·57 grams, and in the opposite quarters, 3·6 grams. Thus the trees with the shortest cuts gave the highest average yield. Dr. Simon considers that this result affords a proof of the fact deduced from microscopic examination, that the latex tubes of each cylinder are in complete communication with one another, and he remarks on the importance of determining the shortest length of cut, relatively to the whole circumference, which will effect as complete an extraction as possible of the latex. [This result is apparently always obtained in tappings of twelve months' duration, or less; but experiments both at Peradeniya and Kuala Lumpur have shown that it does not hold good over longer periods.] He recommends tapping on

opposite quarters; but his experiment was too brief to admit of definite conclusions, and his other two methods were too drastic to afford any rational basis for comparison. Curiously enough, considering the title of his paper, he discusses this question purely from the standpoint of yield.

BARK RENEWAL.

Two of the trees which had been tapped on both sides by a full-herring bone extending over nearly half the circumference were felled, and their renewed bark examined microscopically. One of these had been tapped up to the day before felling, while on the other tapping had been stopped a month previously. The thin layer of cortex left after tapping contained one layer of latex tubes. The outer cells of this cortex layer dry up and form a protective covering, while the cambium continues its normal functions and builds up, on the inner side, new latex tubes, sieve tubes, etc. Seven or eight months after tapping was begun, the renewed cortex at the upper edge of the tapping surface possessed an almost normal latex zone, i.e., the number of layers of latex tubes it contained was nearly equal to that of the untapped cortex.

In addition to the production of new latex tubes by the cambium, growth takes place also on the outer side of the renewing bark, beneath the protecting layer of dead cells. There a cork cambium (Phellogen) arises, which cuts off a cork layer externally and a parenchymatous layer internally. This inner layer ultimately develops a large number of stone cells, and so forms (at least, in part) the outer friable layer of the cortex. Stone cells are also produced by differentiation of the bast cells which arise from the inner cambium.

DR. SIMON states that the latex tubes which are severed at the first cut, the ends of which open originally on the upper edge of the tapping cut, remain recognisable for a long time, then gradually lose their contents and become disorganised. But whether that takes place more rapidly than in normal growth is difficult to decide. They do not develop junctions with the inner untapped latex cylinder, such as occur in other latex-bearing plants after wounding. The new layers of latex tubes in the renewed bark are continuous with those formed at the same time in the untapped bark. For example, in a cortex which originally contained six layers of latex tubes five of these (say) would be severed in tapping and removed completely over the tapped area, and the layer remaining would be continuous under both the tapped and the untapped bark. All new layers of latex tubes are formed at the cambium behind this survivor of the original layers, and hence are continuous. [It scarcely seems possible that this explanation is correct, for it would appear to involve the conclusion that the untapped cortex increases in thickness at the same rate as the renewed cortex.]

Renewal after pricking differs in several important details. In the first place, as was pointed out by Fitting, the cambium beneath each pricker-cut does not behave normally, but for some time afterwards produces groups of stone cells instead of latex tubes and sieve tubes. As the parts of the cambium between the pricker-cuts exhibit their normal functions, the new layers of latex tubes and sieve tubes are interrupted, and consist of short fragments instead of continuous tubes. This effect of the pricker

passes off in about seven months, as has been previously found in Ceylon. Hence pricked bark should take at least six months longer than pared bark before it is re-tappable. A second disadvantage lies in the production of thorns on the wood. Where the pricker teeth penetrate to the cambium, wound wood is formed, and as this is produced in greater quantity than the normal wood, an elevation appears on the wood beneath each pricker-cut. Consequently the renewed cortex, though externally smooth, varies in thickness, being thicker between the elevations than it is over them, and if it is tapped with the knife, either the tapper cuts too deep and makes a wound over each elevation, or he does not cut deep enough to tap the latex tubes which lie between them.

THE DISTRIBUTION OF RESERVE FOOD IN THE TAPPED STEM.

The distribution of reserve food was determined in the two trees already referred to. Each had been tapped on two tapping surfaces on opposite sides of the tree which together occupied five-sixths of the total circumference, up to a height of four feet. On the tree which had been tapped for six months and then rested for one month, the distribution was as follows: In the untapped parts between the tapping cuts, the parts immediately above and below the tapping surfaces, and in the vertical strips between the tapping surfaces, starch was completely absent from an outer zone of the wood to a depth of two to three millimetres; that was succeeded by a zone one millimetre deep which was poorly filled with starch; while the remainder of the wood was rich in starch. The cortex over these regions contained only small quantities of starch in the outer stone-cell layer. On the other hand, sugar was abundant throughout the cortex and in the starch-free zone of the wood.

The surface tapped with the knife showed a similar condition. The new wood which had been formed since tapping began was from five to seven millimetres thick in the upper part of the tapping surface. Of that, the outer four or five millimetres were constantly free from starch; a layer bordering on that, one to two millimetres thick was half filled; while the whole of the rest of the wood was completely filled. The renewed cortex contained no starch, but sugar was present in large quantities, even in the thin layer over the most recently tapped part. Small quantities of sugar were also present in the starch-free wood.

The pricked side showed a somewhat different starch distribution. The new wood consisted of typical wound wood and was totally destitute of starch, and the old wood bordering on that was empty for a depth of two millimetres. The remainder of the old wood was normally filled. In this case the starch had been exhausted to a greater depth, owing to the greater growth of wood. The renewed cortex contained large quantities of sugar.

This result shows that the new growth of wood on the surface tapped with the knife is, wholly or in part, destitute of starch, while in the rest of the wood, except for at most a small zone (one to two millimetres deep) no diminution of the starch reserve can be detected. On the other hand, a greater demand has been made on the starch in the untapped cortex than on

that in the wood beneath the tapping cut. The conditions in the pricked part of the stem are somewhat more unfavourable, since, owing to the greater growth of wood (wound wood), not only is the new wood zone free from starch, but the reserve in the neighbouring layers of the wood has been affected.

The investigation of the tree which was tapped for a month longer revealed a more favourable condition of affairs. The tapping surfaces extended over four-fifths of the circumference, the vertical strips of untapped cortex being 5 cms. broad. Under the untapped parts, as well as under the surfaces tapped with the knife only, a zone of wood barely one half to one and a half millimetres deep was free from starch, the succeeding half to one millimetre was poorly filled, while the remainder was completely filled. In addition, the original cortex in the neighbourhood of the tapped surface contained large quantities of starch in the outer, stone-cell zone, while the inner cortex was starch free. The whole of the cortex contained large quantities of sugar.

In the wood under the pricked surface the distribution was as follows: An outer zone, one millimetre deep, contained no starch; that was succeeded by a zone, three and a half millimetres deep, filled with starch; while the following zone, one to two millimetres deep, was again free from starch. This last zone had evidently been laid down shortly before and shortly after pricking, since it exhibited the internal black marks due to the teeth of the pricker. Following that zone, the next layer, two to three millimetres deep, was half filled with starch, while the remainder of the wood was normally filled.

The distribution of starch described in the preceding paragraph is abnormal, since it does not exhibit the usual regular transition from a region destitute of starch to one densely filled with it. That is due to the fact that the black patches caused by the pricker, which represent areas where the wood cells are killed, hinder or prevent the movement of carbohydrates from the cambium into the wood. Consequently the wood which has been emptied of its reserve during tapping cannot be re-filled; and conversely, any reserve food which is left in the deeper parts of the wood behind the black patches cannot be transferred outwards and made use of.

These investigations afford a more favourable view of the condition of the reserve food in tapped stems than Fitting's researches would lead one to suppose. Though Fitting's trees were tapped only on one quarter of the circumference, he found much greater exhaustion of the reserve food. Dr. Simon suggests that Fitting's trees may have been closely planted, while his were practically isolated trees. His results show that starch begins to be stored in the new wood on the tapped surface soon after tapping, in spite of the large consumption of carbohydrates in that region. Microscopic examination shows that a layer of sieve tubes is left intact with the inner latex layer, and consequently the transference of food is not entirely stopped by the tapping cut. [It should be noted that these results refer only to a short tapping period on trees grown under the most favourable conditions. Further investigation is required, to determine how far they are applicable to plantation trees regularly tapped. That the results show a more satisfactory state

of affairs than those of Fitting's experiments is perhaps not surprising. Fitting's full spiral experiment was carried out from November 8th to February 10th, the trees being tapped daily. His half-herring bone experiment on one-quarter of the circumference occupied from November 8th to April 11th, daily tapping. On the other hand, Dr. Simon's first tree was tapped, on alternate days, from November 11th to May 16th, and then rested for a month, while his second tree was tapped, also on alternate days, from November 11th to June 23rd, and then felled immediately. Though the extent of the tapping surface was much greater in Dr. Simon's experiment, the alternate-day tapping is probably largely responsible for the presence of the greater amount of reserve food. The month's rest allowed to the first tree puts that out of comparison with Fitting's experiment.

[One important point, really the fundamental question for all researches on this subject, appears to have been overlooked by both Fitting and Simon. Is there an annual variation in the amount of reserve food in the stem, quite independent of any effect due to tapping? For example, the new leaves are constructed at the expense of the reserve food, which presumably is thereby depleted until some time after the new leaves have acquired their full capacity for manufacturing food. Neither Fitting nor Simon record the time of leaf-fall of their trees, but had the experiment been carried out in Ceylon, it would have been expected that, owing to the production of new leaves, a minimum of reserve food would be found in February-March, and that the amount would subsequently increase until near the end of the year. In that case, one would naturally expect to find a larger store of reserve food in a tree felled in June than in one felled in April. This question of a possible periodic change in the amount of reserve food in the stem, whether tapped or not, must be decided before any definite conclusions concerning the effects of tapping can be arrived at.]

T. PETCH.

TALL-GROWING TREES OF MANIHOT GLAZIOVII.

The writer has made a number of experiments, both at Amani and in other plantations in German East Africa for the purpose of ascertaining the best methods of inducing height in such plants of *Manihot Glaziovii*, as, by reason of unfavourable climatic conditions or other undetermined causes, flower too early and thus ramify at an insufficient distance from the ground.

The following are the results of one of the experiments made at Amani :

The trees used had been planted in April 1911 and had mostly branched very low down. In September 1911, they were pruned in three different ways : (1) topped at 12 to 16 in. from the ground ; (2) topped immediately below the lowest bifurcation ; (3) at each point of ramification all the branches were removed except the one nearest the stem ; a month later the fresh shoots were removed except the one nearest the stem, a month later the fresh roots were treated in the same way. A fourth lot consisted of plants raised in the nursery and planted out in September 1911 in the place of dead trees, or such as were not growing well.

It was found that the trees of the third group, which had grown zigzag as a result of the pruning, never became straight although they were young and the side shoots were constantly cut off. Further, the terminal shoots at once flowered again and gave rise to new ramifications. Thus, by this means no perceptible increase in the length of the stem is obtained. In the case of the trees of the second lot, new shoots at once made their appearance: these were all removed except the most vigorous, which grew in perfect line with the stem, in such a manner that the point of junction became less and less perceptible. These trees began to branch again much more rapidly than those of the first lot, of which the stems were the highest of these three groups (averaging respectively 5 ft. 6 in., 3 ft. and 4 ft.).

The results obtained with the fourth lot were slightly more satisfactory; under the influence of favourable climatic conditions, these produced very tall stems (5 ft. 8 in.). The average circumference at 3 ft. in the four lots was $8\frac{1}{4}$, 10, 10 and $7\frac{1}{2}$ in. respectively.

In conclusion the method most to be recommended is the topping of the stem at 12 or 16 inches from the ground, which should be done as soon as the first branching begins.—A. ZIMMERMANN IN "DER PFLANZER."

SOY BEANS IN INDIA.

At the present time soy beans are cultivated to a small extent in the Darjeeling Hills, and to no appreciable extent elsewhere in India, but during the years 1909-11 experiments were carried out in Bengal, Bihar and Orissa to ascertain the commercial possibilities of the crop in the plains.

Three definite types of beans have been isolated from native seed and studied. In two cases the oil content was found to be relatively high and the nitrogen content low, while in the other case the reverse occurred; these characteristics were inherited.

The yields obtained usually varied from 650 lb. to 1,000 lb. per acre, though under favourable circumstances they rose to 2,200 lb. per acre; these yields compare favourably with those obtained in Manchuria. The cost of cultivation was estimated at 13*s* to 20*s* per acre, though it might rise to 27*s* per acre. Under these conditions, prices of £5 8*s* to £5 17*s* per ton are required to make the crop remunerative; for the present such prices are not to be obtained, £4 10*s* being offered by merchants in Calcutta. But there can be no doubt that the crop is intrinsically worth more than this, and signs are not wanting that its value as a food stuff is being appreciated, so that a considerable rice in prices is not unlikely.

The varieties used in the experiments occupied the land for two seasons in the plains and the crop had therefore to pay double rent. Efforts will now be concentrated on the production of new varieties combining the qualities of early maturity, productiveness, and high oil content, and if these attempts are successful, the projects of making the crop a remunerative one in India will be far more hopeful.—MONTHLY BULLETIN.

COCONUTS.

COCONUT PLANTATIONS.

MR. C. T. ELMSLIE, who has contributed a brief article on Coconut Plantations to the *Financial News*, takes an optimistic view regarding the industry in the Pacific, as will be seen from the following account we reproduce below. Mr. Elmslie says :—"The profitable nature of coconut planting is very evident to one in close touch with it in the Pacific. Copra has risen in a comparatively short time from £9 to £29 a ton at the present moment, and men well versed in the industry say that it will go to £35 and over. The cost of making up on the plantation is about £4; so the margin for profit is considerable.

The cause of the continuous rise is not far to seek. Copra has always been wanted for soap-making and the refuse for cattle food. The oil, however, is now made up into several edible articles, of which palmine butter is the principal. These products are in growing favour in Europe, but in the United States the demand is so strong that the supply is always insufficient. The changes that this state of things is bringing about in the Pacific are astonishing, and as the demand for copra products is widely expanding there is no prospect of the price declining to any extent.

It is seldom that bearing plantations are offered for sale, and quotations as to prices are not reliable; for buyers might not be able to find properties at any figures at all. Roughly, however, coconut properties are quoted at from £60 to £100 an acre. Land suitable for planting can be got quite reasonably, and the nuts need much less attention than rubber. No fertilising is required, but weeds must be kept down. The first crop comes in the fifth or sixth year, after which a constant good revenue is assured from what has then become a very valuable estate.

Good money is also to be made in acquiring virgin lands, planting and selling; for even at six months old a plantation has considerable value. An area of great prosperity is certainly opening throughout the Pacific, mainly due to the great advance in value of its chief product.

COCONUT PESTS IN SAMOA.

Writing to the *Samoanische Zeitung* on "Battling with Beetles on Coconut Trees in Samoa," MR. H. J. MOORS SAYS :—

Concerning the mixture of tar and kerosene used by me on coconut trees to protect them from beetles, I believe tar alone would answer very well—quite as well, perhaps, as the mixture; but as tar is thick and stiff to apply, the labour bill would be very considerable indeed, and it was chiefly to reduce this item that we mixed kerosene with our tar to thin it down, so that it could flow easily and quickly. Up to date we have not lost a tree that we have treated in the manner I have described.

Many of the trees we have handled had already been seriously bored before we took them in hand. At this wet season it is hard to get natives to climb well-grown trees, and we are just now at a standstill, but as soon as we can do so we will recommence using our mixture. Since the wet weather has been so continually with us an attack of canker has broken out in Ululoloa, and we are fighting it. Unfortunately we did not carbide our trees before the wet weather began, and some of them were in a rather bare state. Amongst these, canker was discovered and, up till now, about sixteen trees have been cut down, and some others are under treatment. Some of them we hope to save.

The loss of trees on this property during the past four years from canker has now reached about 1 per cent. It is noticeable that this canker attack occurred right along the road to the cooly quarters, and it possibly might have been introduced by visiting coolies coming from an infected property and carrying with them, in their clothes, the very light spores of the canker fungus. We have now almost succeeded in repainting all of our trees notwithstanding the wet weather we have had. If any of them were infected by canker germs, before the wash was applied, the canker will quickly develop and show red spots against the white background of the wash. This is an advantage.

In dealing with a cankered tree it is best to spray it or paint all of its affected parts with kerosene or something else before disturbing it if it has to be destroyed ; this to kill loose germs. Likewise, all of the affected bark should be sterilized before the knife is used if there is to be an attempt to save the tree. No one knows for certain the best method of handling canker. We are very sure we do not, and we would be very glad indeed to learn from more experienced people.

We would like to know how to clear out the fruit-fly from oranges. Wind belts are of very doubtful use so far as our experience goes.

THE COST OF MAKING COPRA.

The paragraph on p. 89 in our May issue, quoting the cost of making copra in Queensland as being £18 a ton, caused us to receive several calls, as well as a good many letters, from those either good enough to fall in with our suggestion and give us their estimates for making copra, or from others who wished for further particulars for their own guidance, says *Tropical Life*. As a result of the information received and discussions to date, we have been able to confirm our own opinion that if copra costs £15, £18 or any other sum c. and f., this amount can roughly be divided into three equal parts. One-third would be taken up in the cost of upkeep of large estates, for such areas as are in bearing, provided they were in good order to start with, and needed no exceptional expenditure, as heavy weeding or drainage during the year. One-third for picking the nuts, and transporting them to the factory, for husking, splitting, removing the meat, drying the copra, and bags and bagging for shipment ; whilst the last third goes for transport to the export ship and

freight across. For copra to cost £18 ton, the labour, as in Queensland, must be excessive, or else the cost would come in the transport to the coast owing to the estate being in a district situated a long way from the sea-board. To our mind, for estates of 3,000 to 5,000 acres, or at least 2,000 and the entire area bearing, £15 per ton c. and f. should be, as a rule, a fair average cost for copra, for whether you pay a shilling a day for labour when making the copra, as to some Malays, or about fourpence a day, as with Kaffir or other cheap labour, as in Africa, the cost per ton works out much about the same, a good Malay being equal to three indifferent Africans.

If this is correct, and allowing 2,000 nuts per acre (trees 30 ft. apart), and 6,000 nuts per ton of copra, an estate would cost one-third of £5, or £1 13*s*.4*d* an acre for general upkeep. If the nuts were so large as to need only 4,000 to make a ton of copra (an estimate that we find too low especially for large estates of 3,000 acres), then it would be extremely doubtful whether the crops would cost less to produce, as the nuts would only maintain their size owing to better cultivation and liberal manuring, which would run the cost up to 50*s*. an acre, and hence the same 100*s*. for the two acres necessary to produce 4,000 nuts.

When scientific cultivation by means of power tractors, ploughs, and cultivators and manure spreaders supersedes the present lowclass labour engaged in "chipping" or hoeing the land, it will be interesting to see how the cost per 100 or 1,000 acres compares with present rates. In Portuguese East Africa "chipping," we are told, costs 5*d*. per day's task (half an acre), or 10*d*. per acre. This is done three times a year, so costs 2*s*. 6*d*. an acre, plus the same amount for other expenditure, making 5*s*. an acre per year for work other than exceptional expenditure. Let us, therefore, work out the cost of a coconut estate of 3,000 acres based on the Portuguese Africa basis; and having done this, we hope others still on the spot, and especially those in Malaya, Mexico, Malabar, Ceylon, etc., will criticize our figures and compare them with their own. A coconut estate, all bearing, of 3,000 acres would need the following labour and expenditure in Portuguese Africa :—

		Per annum.
1	White manager's (or owner's) time	£ 800
2	Under-managers at £250 and £200	450
20	Drivers or overseers (equals one to 150 acres) at £5 a month or £60 a year	1,200
200	Labourers (1 to 15 acres) with women and children. If there is not one woman and two or three children to each man then 250 labourers (or 1 to 12 acres) at 5*s*. an acre	750
1	White bookkeeper	250
2	Clerks (native) at £100 year	200
Total for upkeep, for labour only, exclusive of manure, machinery, implements, etc., equal to about £1. 4*s*. 4*d* an acre		£3,650

This area (3,000 acres) in bearing should give (at 2,000 nuts to the acre, and 6,000 nuts to the ton of copra) 1,000 tons of copra costing £3. 13*s*. 4*d* ton, as above for upkeep; add another £1 5*s*. 8*d*. a ton, or £1,350 a year for renewals of supplies, etc., wear and tear, and sinking fund for labourers

buildings (if any), cultivating implements, and estates supplies, etc., and contingencies, makes the cost of producing 6,000 nuts=1 ton copra, exactly £5. In the estimate for making the copra must be included depreciation or sinking fund on buildings, machinery (if any), labour, say 65*s.* ton, bags and baggings, 10*s.* ton, plus at least £3,250 interest on capital value of the estate (3,000 acres at £25=£75,000)=£1 5*s.* a ton, whilst £4 out of the third £5 would go for transport, freight, etc, and £1 contingencies=£15 ton in all c. and f. Suppose the copra costs £12 only, or £18, then we still suggest that these same three-thirds for estate work, copra-making and interest, transport and contingencies would remain pro rata. In the above we have not calculated anything for coir fibre or other by-products, nor for catch crops, either their upkeep or profit, but for cost of producing the coconuts and making and transporting copra only, and that from trees that are practically in full bearing. Now we have made the start and shown our hand, it is up to others to explain where we are wrong, or confirm our statement where we are right. We ask one and all to do so.

The director of the largest plantation coconut concern in Portuguese Africa, if not in the world, maintains, however, that the above figures are much too low, and such an authority as an owner of estates and a large employer of labour is bound to take first rank for consideration. On June 14th last this authority wrote us from Marseilles: "Your figures are too low; according to our experience, you must reckon for 3,000 acres, 300 men during six months for picking and transporting the nuts, 200 men for the same time for opening and drying, 200 men for the other work, as bagging etc. In all, therefore, you need at least 700 men for six months. Besides this, you must further reckon 300 men for the general upkeep of the estate, tending the land, cattle, etc., draining, removing dead leaves, repairs to bridges, *extermination of pests*" (our friend heavily underlines these three words) "and the other work, as on a farm, and this labour force is required for the whole year." By this one must take it that at least 1,000 men are needed, or one man to three acres planted and bearing. The friend who gave us the first set of figures is now in Africa. As soon as he returns we will hear what he has to say and revert to the matter again.

COVER AND SECONDARY CROPS FOR COCONUT PLANTATIONS.

Messrs. O. W. Barett, chief of Experiment Stations, Philippine Island and P. J. Wester, Horticulturist, have contributed the following suggestions on cover crops for coconut plantations in the *Philippine Review*:—

Depending upon the soil, climatic conditions, the variety planted and the care of the trees, coconuts do not begin to bear until in their fourth or seventh year from planting, and a full crop may not be expected until the trees are eight to ten years old. During this period the exchequer of the owner is subjected to a continual drain of "upkeep" money if the land is devoted to coconuts alone. To decrease this expense and obtain some revenue from the land during the "adolescence" of the plantation should therefore be the aim of every grower of coconuts. Secondary or "catch" crops offer a solution

of the difficulty ; but even the handling of these calls for experience and careful attention and, unfortunately, no fixed rules can be laid down to fit all plantations. Cover crops are very good indeed for the health and rapid development of the coconut grove, but they cannot be expected to give a quick return *in cash* to the owner.

For instance, from the ordinary legume cover crops, such as Lyon bean, velvet bean, mani-maniham, cowpea ('sitao'), jackbean, guar, pigeon pea ('cadyos'), ipil *(Lucæna glauca)*, and madre cacao, &c., but little actual revenue can be obtained, the benefit from planting these crops consisting in the shading and enrichment of the land and the conservation of moisture, thus hastening the development of the trees. Planters who are just beginning to use cover crops should remember that the advantages derived from them are : First, they keep the surface of the soil cool and moist through the hot dry season—a matter of very great importance to young coconuts ; second, they store up nitrogen (condensed plant food) in their roots; third, their roots improve the soil physically ; and fourth, they form a natural blanket on the soil surface, which prevents the rains washing away the highly valuable dead vegetable matter accumulated there : all these points are really of much greater import than the average planter appreciates. Almost anyone can make a profit growing coconuts, but, other things being equal, the planter who employs cover crops is practically sure to win out away ahead of his neighbour who either follows the reprehensible *laisser faire* plan of letting the weeds and grass grow as they will or who tries at unnecessary expense to keep the interspaces clean.

The proper management of cover crops is an art in itself. Briefly, the running of trailing sorts may be broadcasted in the rainy season ; but the drill system is usually the most economical as to seed and care of the plants until they get well started. The shrubby species, like the pigeon pea, ipil, madre de cacao, and even the semi-shrubby ones, like the guars, the crotalarias and cassias—all these should be planted closely in hills in rows between the coconuts. The various vines may be rolled or cut with a disc harrow if they should get too luxuriant during the rainy season ; if they climb upon the young palms too rampantly (a *good* fault, indeed) a boy with a stick may be sent along the rows once or twice a week, to poke them away. The shrubby and semi-shrubby kinds may be cut back occasionally in order to make them spread out at the bottom and shade the entire surface ; a good sharp bolo in the hands of an ordinary labourer is all that is necessary for this beheading operation. The lopped-off material quickly turns into humus on the soil surface. If carefully managed there need be but very little danger from fire ; some of the shallow-rooting species may die during prolonged drought and so become a menace, but the possibility of such an occurrence need never worry the planter in ordinary coconut regions. Most of the legume covers can be used either as hay or as green forage or browse for goats, pigs and even cattle. Some kinds are also important as human foods.

That the thrifty planter will need at least a few secondary crops goes without saying. Space forbids a full discussion of this interesting subject ; but we beg to remind every coconut grower that it is his duty to raise a great part of the labourers' food as well as the animals' feed *on the plantation itself*. If due attention is paid to the ordinary principles of crop-rotation and management, all or most of the following catch crops, grouped according to their uses, can and should be raised on every coconut hacienda:—First-class foods: Maize (in variety), sweet potatoes, beans (of many sorts), peanuts, pineapples, upland rices. Second-class foods: Cassava, bananas (of many

kinds), papaya, roselle. Third-class foods: Millets, grain sorghums, dasheens, and yautias, (aristocratic relatives of the old ("gabe"), sincamas (yambeans). Forage plants: Sorghums, maize, millets, and in the rainy season and in moist soils, Guinea grass, Rhodes grass, and possibly Natal and molasses grasses. Generally speaking, none of these catch crops should be planted within 1·5 metres of the young coconuts; legumes, however, may be planted close up to the base of the stem.

Another matter which affects the status of the coconut estate is the raising of a good supply of vegetables and fruits in good variety; a home garden and home fruit orchard not only make life pleasanter and dietetically safer for the families of the superintendents of all grades, but the surplus can always be readily disposed of either in the local markets or, in case of some sorts, among the labourers.

The following vegetables and fruits are recommended for general culture on all coconut lands:—First-class vegetables: Tomatoes, egg-plant, lettuce, beans, pechay (Chinese cabbage), radish. Second-class vegetables: Beets, carrots, okra, peppers, turnips. First-class fruits: Mangoes, avocados, citrus fruits (orange, mandarin, lime, calamondin, lemon, pomelo), the anonas (custard-apple, sugar-apple, soursop, cherimoya, and the new hybrids), carissa, carambola, and balimbing. Besides the general-purpose collection of fruits and vegetables, every well-managed estate will have an experimental or trying-out collection; this not only breaks the hum-drum routine of estate work and adds a zest to life, but experiments (even negative ones) almost always *pay* in the long run—to say nothing of the fun.

MANURING OF COCONUTS

TO THE EDITOR OF THE "TROPICAL AGRICULTURIST."

SIR,

Will you or any of our experienced coconut planters give the following information through the medium of this magazine and oblige.

1. To obtain the best results is it imperative to have the soil turned up at each application of the artificial manure? If so, in cases where manure is applied once in every two years will not the second soil-turning damage those roots which came out as a result of first manuring and thereby put a stop to that vigorous nourishment resulting from manuring? At the end of two years are not these roots in the prime of their life and are better able to nourish the tree for at least another two years if left uninjured? Which roots, whether surface soil or subsoil roots, do more work as food carriers to the tree?

2. Which way of manuring is better, whether in full circles or half circles? Whether the trenches should be broad or narrow? Whether they should be close to the tree or at some distance from it?

3. On high lands in a dry district is it injurious or useful to have trenches opened up? These to be filled up by degrees with cadjans or other refuse?

4. Which is better, whether *burying* of cadjans or other refuse by covering the above-said trenches when they are full in about one or two years or burning the refuse and applying the ash to trees?

H. P. W.

Marawila, 18th August, 1913.

CACAO.

THE PREPARATION OF CACAO.

By E. PERROLI.

The cacao which finds its way to the European markets from the countries where it is produced undergoes fermentation after being gathered. The conditions of this process are as yet undetermined, with the result that the cacao-making industry has to deal with an extremely variable product. The operation has the double aim of destroying the sweet mucilaginous pulp which adheres closely to the seeds of the fruit, and to produce useful chemical changes in the kernel.

In a first series of studies, undertaken with the object of making the preparation of cacao more systematic and less difficult, the writer found that the method at present in use could be modified with advantage by using a mechanical process for removing the pulp after a preliminary treatment of the fruit with a weak alkaline solution : The fresh seeds are macerated for some hours at a temperature of 45° to 50° C. in a 1 per cent. sodium carbonate solution and are then left in a warm, damp spot until the pulp has undergone sufficient transformation. Unfortunately, this process gives every opportunity for the growth of moulds, and for this reason the writer has undertaken new investigations with a view to sterilizing the fresh seeds.

By the simple action of steam under slight pressure in an autoclave, seeds were obtained which after the pulp had been removed mechanically presented an excellent appearance. The flesh of the kernel retains its beautiful violet colour after desiccation, showing that the tannic compounds had undergone no chemical change. The sterilized seeds were reduced to powder and then subjected to two kinds of tests, the one of a chemical, the other of a biological nature. From these it was concluded that it is possible to obtain changes in this sterilized powder in the laboratory which are comparable to those in the course of the present method of preparation as practised in the countries where the cacao is grown and that the latter would derive considerable benefit from the adoption of the new process. —MONTHLY BULLETIN.

COTTON.

COTTON IN THE MONTSERRAT BOTANIC STATION.

The following extract is from the Annual Report of the Montserrat Botanic Station of the Imperial Department of Agriculture for the West Indies :—

The area planted in cotton in the season 1911-12 was estimated to be 2,700 acres, and the amount of cotton lint shipped was 346,568 lb., value £25,210 ; thus the average return per acre was 128 lb. of lint. This is the largest area in cotton since its introduction ten years ago. At present the only means of arriving at the acreage is to get the figures from the proprietors themselves, and in the case of small growers the figures are obtained from the Treasury records, a licence being necessary before a grower can sell his cotton locally ; so that the acreage is as nearly accurate as it is at present possible to make it.

The tendency to plant the crop early is giving useful results and in future the bulk of the planting will be done in April and May. The season 1911-12 was not favourable throughout, dry weather prevailing in the months of August and September, just at the time that the bolls of the cotton plant were swelling. With regard to pests, the cotton worm and leaf-blister mite were present as usual, many of the small growers in the Little Bay and Rendezvous districts having their cotton seriously damaged by the former, the pest appearing here in numbers for the first time. The cotton stainer is increasing in importance as a cotton pest, and many planters are finding it necessary to adopt means of control. There seems to be a diseased condition of the boll present in the cotton fields, not hitherto taken into account. In this, the bolls are apparently quite healthy until they open; it is then seen that the lint is discoloured and matted. The point is that the diseased condition cannot be seen until the boll opens.

One cannot avoid coming to the conclusion that much of the cotton land, both on the windward and leeward side of the island, would be benefited by additional shelter belts. These need not necessarily be permanent, but it should be mentioned that none of the plants at present used as temporary shelter-belts are very satisfactory. Guinea corn, which has been used, is too liable to be blown down, and the pigeon pea, which is chiefly used at present, does not grow tall enough. Moreover, the pigeon pea as a rule is planted with the cotton, and consequently does not benefit the cott n in the young stages; and this is the time when shelter is most needed. There would seem to be no reason why the bay tree should not be planted experimentally as a wind-break.

On the other hand, it seems possible to make the conditions too favourable, as it is often noticed that in very fertile and sheltered places the cotton planted at the usual distances grows so thickly that much of the cotton is lost owing to the breaking of the branches during picking and, to some extent, on account of the dampness. These places are, however, not common.

THE KAPOK INDUSTRY.*

The principal object of this bulletin on the subject of kapok floss is to introduce this little-known product more widely, now that, by improved methods of cultivation, cleaning of the floss and a new method of rendering the floss possible for spinning purposes, the product has become of some commercial value.

The tree itself, *Eriodendron anfractuosum* is widely distributed in the tropics. It has many near relations including Bombax, but all yield an inferior floss to that of the kapok.

Java was one of the first countries to take up the cultivation and export seriously, but the Philippines have now followed suit. The main use of the floss, which is very elastic, is for stuffing cushions and upholstery.

The author states that the trees should be propagated from cuttings from trees yielding the largest quantity of big pods containing floss of the best quality and colour. Trees grown from cuttings yield a crop 6-12 months earlier than those raised from seed. The first crop may be expected in the third year from planting.

If raised from seed only selected seed from good big pods with a thin husk should be used, and planted in a nursery 15 centimetres apart. The seedlings should be ready for planting out in 12 months' time.

The climate best suited to the kapok tree is a warm one and a mean elevation of 500-1,000 metres. Nor does it require a large amount or even distribution of rainfall and it can withstand a drought. It is most essential that there should be little or no rain from the time of flowering until after the pods are harvested or the quality of the floss will be inferior. This period takes about five months.

The tree being very brittle does not like strong winds, and cyclones are fatal to it.

The soil it prefers is of a volcanic substance, but it does well also in alluvial and sandy soils.

The trees should be planted $6 \times 6\frac{1}{2}$ metres and require very little cultivation.

The pods should be harvested directly they show signs of ripening by turning brown, or they will open and much floss be lost. The trees being too brittle to climb, long cocoa-pickers must be used. The pods should be graded and then opened as soon as possible after picking.

The author describes several methods of hand-cleaning for the benefit of the small cultivator, but there are three kinds of machines now invented for cleaning the floss expeditiously and well. The floss is then ready for baling in much the same way as cotton is baled and shipped. Holland is the largest consumer at present as all the best kapok comes from Java. Silk cotton has been exported from India and Ceylon but being the produce of Bombax the floss is of poor quality.

* Bulletin No. 26, Bureau of Agriculture, Philippine Islands.

A hectare planted in kapok containing 280 trees should yield about 450 kilos in the fifth year and 650 in the ninth.

In 1912 the price was 90 centavos per kilo and the price tends to advance owing to increased demand as further uses are found for it.

One of its chief uses is for filling life-saving appliances, but this of course has only a very limited market; a wider market is that for the stuffing for upholstery for which it is particularly adaptable.

But the real commercial value of the floss will be recognised when the spinning of it becomes perfected and both new machinery and new processes of treating the raw material are being exploited. It is said a yarn of very fine, soft, silky quality can be obtained from it when treated by a process still kept a secret.

From the seeds oil of a fairly good quality is obtainable and the residue can be used as a cattle-cake.

The tree seems to suffer from very few known diseases—a cotton stainer in the pods and Helopeltis being the most serious.

Finally the author declares that the Bureau of Agriculture is so satisfied with the outlook of this industry that they contemplate seriously attempting to establish the industry in the Philippines and in advertising its excellent qualities to the commercial world.

D. S. C.

COTTON IN EGYPT.

Mr. W. H. Cadman, B.Sc., F.C.S., has written a note on Agricultural Progress in Egypt to the Consular Report on the Trade of Alexandria for the year 1912 from which it appears that forty-four cotton demonstration farms were formed to serve as models to cultivators. The Department distributed seed and issued instructions as to sowing, irrigation and cultivation. The crops were much larger than those in neighbouring fields, and one district yielded 10½ cantars (cantar=99·05 lb.) which had never previously produced more than 5 cantars. The Department undertakes the entire distribution of cotton seed. Cotton breeding experiments are being carried on at the Mendelian Experimental Station.

The Government now supervises the compulsory picking of affected leaves by hand and arrange for lectures on the subject in the mosques. Their efforts have been most successful and exercised a marked effect on the crop in 1912.

Experiments are being carried on by the Government entomologist for the further introduction of parasites which prey on the Pink Boll Worm.

To prevent the introduction of disease from imported plants, seeds, etc., all arrivals will now be thoroughly fumigated before delivery.

Ninety-three cotton markets have been established in the provinces to protect the fellaheen. Latest market prices are publicly posted and an official weighing machine erected. The latter is very necessary in a country where the trade of weighing is carried on by public weighers whose machines can easily be manipulated.

HOW TO GROW SEA ISLAND COTTON.

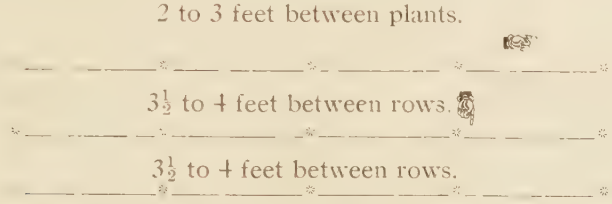
While cotton will grow everywhere in Jamaica, from the seaside to over 3,000 feet in the hills, and wild cotton is common, the particular variety of cotton which has been grown since 1904 when cotton growing was taken up here—again because it is a native of the West Indies, produces the best quality when grown near the sea, and cannot be grown where the cheaper qualities of cotton can be grown, while it fetches the highest price in the market—is Sea Island Cotton. The common cotton growing wild here is either Kidney Cotton or Upland Cotton, and neither are of any use for our purpose, and any plants of these kinds growing near where we are going to cultivate Sea Island Cotton should be cut down in case they cross and spoil our seed for planting. There are other varieties of cotton grown commonly for the manufacture of cotton goods and for which there is a much larger demand than for Sea Island Cotton which goes to make only the finest qualities of goods. The most commonly grown is Upland Cotton, called a short staple cotton. Sea Island Cotton is a long staple cotton ; its fibre is long, and fine and silky. There is another variety of cotton also long staple but coarser than Sea Island which grows more vigorously, and gives a larger yield, and that is Egyptian Cotton. It may be that this variety may yet be grown here instead of Sea Island Cotton because of its stronger growth and large yield although it fetches a less price. However, meantime we are growing the Sea Island variety fairly successfully and it is this variety we shall deal with here.

The Sea Island Cotton is best grown in the lowlands, for although it will grow well in the hills, and inland, there is more expense to get it marketed from there, while other things will grow in the hills better. And it usually gives better quality when grown near the sea. The idea is to grow cotton where the people cannot grow bananas, coffee, and cocoa, and have little choice through deficient rainfall what they can grow to ship abroad and bring money into the Island, and it is just in such places that Sea Island Cotton grows well. Guinea grass, cassava and sweet potatoes, &c., we only sell to each other, but we want something extra to sell abroad in such districts. Light soil and a dry climate suit Sea Island Cotton best, and so we have plenty of districts to plant in.

The prices for the cotton grown here since the year 1907 have been very satisfactory.

The land should be forked, or ploughed roughly, not later than the beginning of July, for planting in August, and left to weather for a time. Then it should be gone over again and made as fine as possible before planting. If a plough is used, shallow drills should then be made, four feet apart, and three to four seeds planted together, every two to three feet. If the hoe is used, holes should be made in the forked land exactly as if planting corn two to three feet apart, three and a half to four feet between rows, and three or

four seeds dropped in, covered not deeper than an inch, and the soil pressed down with the blade of the hoe. The lines should be kept as straight as possible each way like so :



The seeds can be roughly tested before planting by flinging them in a pan of water, letting them stand an hour, and taking out all those that float, as bad.

In ordinary seasons rain falls in the lowlands about the 12th of August, and showers usually continue through August. The land should be all ready by the end of the first week of August, and when rain falls after the 15th, planting should begin and may continue up to the 15th of September. But if rain falls, the nearer the 15th of August planting is done the better. If no rain falls until October, which would be exceptional, of course planting would require to wait until then.

The young plants will appear—just like young peas—in three or four days, if the soil is moist, or rain falls, and if all of them grow, all but one, the strongest should be cut off close to the earth with scissors. But if any plants fail or grow weak elsewhere, two may be taken out gently, not by pulling but by raising up the earth, preferably with a trowel until they come out easily. Then the earth should be pressed down firmly around the plant left. Those taken out should immediately have their roots dipped in a mixture of earth and water, like mud, to preserve the roots from drying, and be planted where needed at once. They should not be exposed to the sun, and after planting, a leaf or branch with leaves should be stuck in, leaning over them to shade them. Unless this care is exercised it is better to plant fresh seeds where supplies have to be made.

Where planted so wide as four feet between the rows, and all the land having been forked or ploughed as is recommended, and if rain falls well, a crop of Cowpeas or Kidney beans or Black Eye peas can be taken off between the rows, but the land must be kept clean weeded round the cotton plants.

We insist that it is best to fork or plough the land through to aerate it, and make it easy for the young roots to spread. The more the roots are able to spread through the soil, the more food-stuff they will be able to absorb, the quicker they will grow and the better they will bear.

But when men are late in making up their minds to start, and have to get ready in a hurry, the wire grass or other grass can be hoed off and, when dried, drawn into rows, leaving a two feet space between rows. These rows can be forked right through or if the man is in a big hurry (which, of course, he should not be) holes may be forked two feet apart, and planted three seeds to a hole. These will grow well, and the rest of the soil can be broken up between the plants at leisure. If dry weather comes along, the dried grass between the rows can be drawn close to the plants as a mulch and for manure. Two weedings are generally enough.

In November and December the plants will flower, and in January picking will begin. When the bolls open and the cotton looks fluffy and loose, it is ready for picking. Women and girls do the picking of cotton best as their fingers are more supple and slender than men's One practical lesson is better than a written description of picking. The cotton must be taken out with the first three fingers, clean and in one bit, and not torn out in several attempts. The pickers wear aprons to drop the cotton in, and when the aprons are full, they empty the cotton in large baskets placed in the row, which again, when full, are taken to store and the contents weighed. The pickers are paid by the weight picked.

Cotton should only be picked when dried, and so picking does not begin until the dew is off. If it happens to get wet, after picking, it is spread out to dry in the sun for a couple of hours and is all right again. It is taken by carts to the ginnery for the cotton to be separated from the seed. The seed here generally weighs from 70 to 75 per cent. of the total weight, leaving a little over a quarter of the weight of cotton generally, 28 per cent. Egyptian Cotton gives a larger percentage of lint to seed, than Sea Island Cotton and this ought to be taken into account. It requires machinery for the oil to be taken from the seed, and as we have none here—more is the pity—it requires to be exported. The oil is used for cooking as "sweet oil" and for making soap. The meal after the oil is taken away is used for feeding cows, and for manure. If we had poper machinery here—and there might be if there was plenty of cotton seed to keep mills going—we could supply our own sweet oil, make our own soap, feed our dairy cows, and find cheap manure for the land.

So that a cotton industry would mean much more to Jamaica than only exporting cotton :—

1. It would untilize very dry lands where other crops fail at present, producing almost nothing, so that they could give a gross return of from £8 to £10 an acre, and a net profit of £5 to £7 per acre.

2. It would employ women and girls in the light work of picking; just the class who find it hard to get work suitable for them.

3. It would enable us to own oil mills and soap works here, and so employ more labour ; would save us importing oil and soap, cotton seed meal for cattle feed, and fertilizer for enriching our fields.—JAMAICA AGRICULTURAL SOCIETY'S JOURNAL.

ERRATUM.

In page 152 of Vol. XLI., No. 2., line 7, from bottom, for "pumped" read "poured."

PADDY.

THE MANURING OF PADDY.

The Agricultural Bulletin of the Federated Malay States for July contains a thoughtful article on Malayan paddy soils by Mr. M. Barrow Cliff, from which the information given below is abstracted :—

Before discussing the question of the manuring of paddy the results of some analyses made for the purpose of estimating the quantities of the various plant foods removed by the crop may be given.

They represent the average composition of several rice plants received from the Economic Botanist, and the results are calculated on the assumption of a yield of 400 gantangs of paddy per acre.

The dried plants were composed of straw 55·0%, husk 12·5%, and grain 32·5%, containing.—

	Nitrogen	Potash	Phosphate
Straw	0·70%	1·92%	0·078%
Husk	0·79	0·594	20·68
Grain	1·70	0·298	0·414

400 gantangs of paddy represent:—

1,450 lb. husked rice containing 24·65 lb. N, 4·32 lb. K20, 6·00 lb. P205
593 ,, husk ,, 4·68 ,, ,, 3·52 ,, ,, 1·59 lb. P205
2,497 ,, straw ,, 17·48 ,, ,, 47·94 ,, ,, 1·94 lb. P205

so that the total plant food removed per acre is 46·81 lb. nitrogen, 55·78 lb. potash, and 9·53 lb. phosphate.

In Java the practice exists amongst the native cultivators of burning the straw and husks and returning ashes to the sawahs. By doing so no less than 51·46 lb. of potash (90%) and 3·53 lb. of phosphate (37% of the total removed) are put back.

This practice therefore is a sound one, it involves little trouble, and its employment should be encouraged.

When this is done there is still an unavoidable loss of 46·81 lb. nitrogen, 4·32 lb. potash, and 6·00 lb. phosphate per acre per 400 gantangs of paddy removed.

Malayan soils seem to be well supplied with nitrogen, seeing that each 0·1% in the surface 6 inches represents over 2,000 pounds per acre, sufficient for 40 crops. Moreover considerable quantities of this element, in the form of nitrate and ammonia, are brought on to the field by the irrigation water

as has been demonstrated by der Berger in Java. Further quantities are accumulated between the paddy seasons by the weeds which spring up and which are subsequently ploughed or changkolled under. There seems therefore to be little need to apprehend deterioration of these lands through lack of this important element. At the same time large though the amount of nitrogen present may be it needs to be made available for the use of the plant, which it can only be if the soil by cultivation and drainage is adequately aerated. The growing of a leguminous second crop, a practice not as yet employed in this country, must also be of value in improving the soil. On the other hand, as pointed out by Dr. Simon, when the paddy field remains under stagnant water for any length of time, deterioration sets in.

When considering the manurial requirements of a soil what is known as the Law of Minimum should be well borne in mind. This states that the yield of any crop depends upon the available supply of that essential element of plant food that is present in least amount, or, in other words, that no super-abundance of plant food generally can compensate for a deficiency in any one essential element. We have seen that in all probability under normal conditions there should be no deficiency in nitrogen; the elements potash and phosphate remain to be considered.

Paddy soils invariably contain a considerable proprtion of clay, and al clays are rich in potash. Just as in the case of nitrogen the potash too needs to be made "available" to the plant, a change also assisted by the weathering which takes place when air has free access to the soil.

Generally, although the total reserve of potash present is much greater than that of phosphate yet the "available" quantity is little more. This is due to the well-known fact that whereas soluble potash salts are easily leached out of the soil, phosphates are retained much more tenaciously. (For this reason much more potash than phosphate is brought on to the land by the irrigation water.) Not the least of the advantages of growing a second or cover crop on the land is that it assimilates the potash as it becomes available and prevents it being leached out subsequently, after being ploughed under, yielding it up again for absorption by the roots of the rice plant.

Of the three essential elements, phosphoric acid has the greatest tendency to deficiency and, what is more, phosphatic compounds are as a rule less decomposed by weathering, &c., than potash compounds, i.e., phosphate becomes available to the plant at a slower rate although it is more permanent and less easily leached out. This is illustrated by the established fact that the maximum effect of basic slag and other of the insoluble phosphate fertilisers is often only attained in the second and even the third season after application.

The conclusion arrived at, therefore, is that it is in phosphoric acid that the soil of only average fertility is most likely to be deficient, and that if it is possible to find a fertiliser sufficiently cheap and beneficial to be commercially applicable to paddy lands it will prove to be one that has phosphate as its dominant if not its only constituent.

An instance is given of land which by the liberal application of manures containing phosphoric acid as the chief ingredient yields 1,100 gantangs per acre, while the adjacent land gives but a poor return. The suitability of bone manures for paddy has been proved in Java.

Poor yielding soils have been found to contain little phosphate, while among the more fertile types a fairly close relationship exists between the yield and the "available" phosphate.

The relative value of different phosphatic manures on paddy is about to be tested by the F. M. S. Department of Agriculture.

C. D.

PADDY CULTIVATION IN CEYLON DURING THE XIXTH CENTURY.

By E. ELLIOTT.

(Continued from p. 119)

Having completed the review of the past, I will now proceed to discuss the measures in my opinion likely to foster the further development of the industry.

In the various steps taken or advocated with this view in recent years, both officially and unofficially, it has been overlooked that there has been a very satisfactory advance in the production of paddy during the past 30 years, not only in the irrigated districts but also in other parts of the island exclusive of Jaffna.* As a consequence, the success of the policy of the past has not been sufficiently admitted nor the propriety of adhering thereto fully recognised.

As I have already shown the cardinal points in this have been

CHEAP WATER AND CHEAP LAND.

This was specially the case in Batticaloa, when under the energetic action of Woodford Birch, and the free hand in those days accorded to Government Agents, a very large extent of land was, *previous to survey*, given out on license for cultivation on very easy terms, *payable in kind*. Under this system cultivators with very limited means were enabled to undertake the *aswedumization* of moderate extents during the first two years, when profits are as a rule small and eventually to arrange for the necessary one-fourth of the purchase money (under Sir H. Ward's minute) when the land was put up for formal sale after survey.

It must be further remembered that no water rate or other additional impost on land was levied in Batticaloa on account of the works executed prior to 1872; while of the large sums expended subsequently under Sir H. Robinson's scheme, the cultivators were held liable for about 25 per cent. of the total cost; and that consequently the repayment was at rates varying from 22 to 37 cents per acre per annum for ten years. Nor was there any recovery of the maintenance rate prior to 1894 (see Sessional Paper XIV of 1903 Table V).

To these favourable initial conditions may be ascribed the great success which has attended irrigation in Batticaloa where the cultivated area has increased from about 20,000 acres in the fifties to 91,000, the area cultivated in 1900.

*Of the total increase of 116 per cent., irrigated districts contributed 66 per cent. and others 50 per cent.

Again, the great development at Tissamaharama (Hambantota district) from a few acres in 1871 to 6,000 (the area cultivated in 1907) is due to similar encouraging and considerate treatment. Here the land was sold in the earlier years at the upset price, payable in four annual instalments, and there was no charge for the water, prior to 1895, when a small maintenance rate of 10 cents was imposed and a water rate of Re 1/-in perpetuity in all subsequently sold. There was practically no resident population in the locality but these terms attracted settlers from a distance of over 40 miles and over, who have developed the land without any further aid from Government.

In Kurunegala and Nuwerakalawiya there has been a considerable expenditure on major works, but the rates have been in no case higher than Re. 1/-per acre and the land benefited was already almost entirely private property. But the great increase in production in both these districts is due to the restoration of the village tanks, to which the villagers contributed in labour and Government contributed the necessary money and supervision free. So here too the conditions of cheap land and water were fulfilled.

In 1901 came the first advance in the Government terms, by the recovery of the maximum rate in perpetuity from Re. 1/-to Rs. 2/-. The maintenance charge for works, the first cost of which had been repaid, was also increased from 10 to 50 cents per acre. This moderate advance, in view of the abolition of the grain tax, was justifiable.

But in 1906 the limit to the charge in perpetuity was abolished and a maintenance rate based on the actual cost for a previous term of years substituted for the fixed maximum rate formerly leviable.

In the report of the Director of Irrigation for 1907, it is sought to justify these increases on the ground that when Government took a tenth of the crop, this amounted roughly between Rs. 3/-to Rs. 6/-per acre. This may have been true in exceptional cases, but the figures show that the average rate for the whole island was only Re. $1\frac{1}{2}$ and in Batticaloa only Re. 1/-* per acre per annum.

As other grounds in support of this advance it is alleged that much higher rates are imposed in India and consequently there is a substantial return on the outlay on Irrigation. But it has been ignored that a large proportion of these results are obtained by crediting to the works a very considerable proportion of the land assessment (or rent) amounting (as stated in Mr. Strange's recent report) to nine-tenths in Scinde and four-fifths in Darwar. But even then according to Sir Charles Elliott's recent article in the *Empire Review* on Irrigation in India, it is not paying its way, as shewn by the figures he gives—viz:

The total expenditure was Rs. 440 millions on $6\frac{1}{2}$ millions of acres or Rs. $67\frac{3}{4}$ per acre.

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*The highest average commutation rate in districts where irrigation works were executed were as follows: Gangaboda Pattu (Matara) Rs. 1·85, Kandeboda Pattu (Matara Rs. 1·17, Giruwa Pattu West Rs. 1·97. It was only over Rs. 2 in parts of the Central Province and Kegalle, where climatic conditions are more favourable and the price of paddy higher than in the low country districts.

One-third of this expenditure in the Punjab returned 6¼ per cent; one-fifth 3 per cent. and the balance 1 per cent.

The *actual loss* was Rs. 73 lakhs per annum reduced by expenditure on *famine relief works* to Rs. 42 lakhs, *which is the permanent charge to the State.*

In Ceylon as has been already shewn the net expenditure to the end of 1906 on works then in operation was say 5 million rupees. In view of the rate at which Government can raise money, 4 per cent. on this sum or say 2 lakhs of rupees may be taken as the outside "permanent charge to the State" in this island, inclusive of the outlay on what in India would be classed as "famine relief works."

As I trust an indication that there will be no further hardening of irrigation conditions, I have received with much pleasure a recent authoritative assurance that it is not intended to adopt the proposed mode by Mr. Strange in his recent report to declare all public water to be the property of the Crown or to vest all irrigation works (including the village tanks largely restored by the land owners' labour) in the Government. But I trust that there will in future be a fuller recognition of the principle he has stated in the following terms :—

"A capitalist is essential for large irrigation operations—Government is the largest capitalist in a country and is in the most favoured position to undertake such developments for it can reap both *direct* and *indirect* profits from such an enterprise. Moreover it has a duty to perform to the agricultural inhabitants who form so large a proportion of the subjects. The policy it should prefer is to furnish all the capital required and to give all the assistance it can afford. *The capital will consist of the irrigation works themselves.*"

In laying down this conclusion the writer was probably not aware he was repeating the view of an ancient Sinhalese King Dhatu Sena (A.D. 459) who when pressed by his rebellious son to disclose where his riches were concealed, according to the Mahawanso, pointing to Kalawewa, replied, "There are the treasures I possess."

(To be continued).

FRUIT.

ANONA CHERIMOLIA AND A. PALUSTRIS.

TO THE EDITOR OF THE "TROPICAL AGRICULTURIST."

DEAR SIR,

People who do not know the cherimoyer are apt to confuse it with what may for want of a better name be called the "Monkey-apple" (*A. palustris*). The latter, which monkies are said to be partial to, cannot be classed among first or second class fruits. Some people would give the Avocado pear a high place though it has none of the qualities which go to make up "fruitiness" The monkey-apple is of the same character, and can only be made palatable by means of extraneous aids which good fruits have no need of.

There is one characteristic about the monkey-apple and that is that, unlike the durian, its smell is its only recommendation: but there is little flavour about it, though with the aid of sugar the fruit is just edible. I found *A. palustris* offered for sale with other nursery plants in Bangalore: so that there must be a demand for it. The tree is rather handsome, particularly when it bears a large number of seemingly luscious fruit. Owing, however, to the fact that neither the cherimoyer nor the monkey-apple is very familiar the latter is apt to be confused with the former. I recently cleared up two doubtful cases in which the monkey-apple was taken to be cherimoyer.

The cherimoyer, which has been classed with the mangosteen, would seem to be particular about the conditions for its growth, as its distribution is very restricted. Macmillan in his *Handbook of Tropical Gardening* says: "The tree is best suited to the Hill Districts with a rather dry climate and is considered to thrive best on a hard stiff soil in which lime is present." On a recent visit to Ragala I found it growing there at its best.

People living in the low country frequently apply for plants of the cherimoyer but there is little use in trying to grow the tree at low elevations.

It would be interesting if those of your correspondents who have succeeded in growing the fruit will give their experience.

Yours truly,

C. D.

PINE-APPLES.

In the Report on the Botanic Station, St. Kitts-Nevis for 1911-12, issued by the Imperial Commissioner of Agriculture for the West Indies will be found an account of the experiment with pine apples which is a continuation of that reported on in the Annual Report for 1910-11. The experiment was laid out with a view to ascertaining if the disease known as black heart could be controlled by good cultural methods. At the same time manurial experiments, and planting in beds and rows at different distances apart, were included. One half of the plot was planted on banks 3 feet wide, suckers 15 inches apart, and the other half flat in beds, suckers 15 inches square.

The manurial experiments were conducted separately in each half of the plot, and are as follows :—

No. 1. No manure.
No. 2. Pen manure.
No. 3. 10 lb. nitrogen as tankage per 1,000 plants in four doses.
No. 4. 20 lb. potash as sulphate per 1,000 plants in four doses.
No. 5. 8 lb. phosphoric acid in four doses.
No. 6. 10 lb. nitrogen as tankage, 20 lb. potash, 8 lb. phosphoric acid in four doses per 1,000 plants.

These manures were applied by sprinkling over the crown of the plant

The suckers planted in the rows, which were larger than those planted in the beds, began to bear in May 1911, the first ripe fruit being picked in July 1911.

To ascertain if the black heart disease was present, some of these pine-apples when ripe were distributed to persons in the island with a request that a report should be given as to freedom from disease and general condition. In almost every instance it was found that the black heart disease was present if only in a slight degree.

A sample pine from each plot was sent to the Commissioner for the report of the Mycologist and six were sent to Antigua to the Superintendent of Agriculture, and in each case signs of the disease were present.

The following conclusions were arrived at from this examination :—

(1) That planting suckers obtained in St. Kitts in a district where pine-apples are cultivated practically not at all does not result in immunity from the black heart disease.

(2) That the occurrence of this disease is not affected by the manurial treatment which the plants have received, and that fruits produced by plants grown under the most favourable conditions and carefully manured are liable to be infected.

As the suckers established in the beds did not come into bearing during the period under review, no account can be taken of them or any results as to planting at different distances. With reference to those set in rows and manured, as stated above, the following table will give the number and weight of fruit picked from each row up to the end of the season :—

Plot No.	Number of fruit.	Weight, lb.	Average weight of fruit, lb.
1	26	73	2·13
2	37	107	2·14
3	27	83	3·0
4	43	118	2·12
5	35	99	2·13
6	35	102	2·14

These pine-apples are continuing to bear and, at the time of writing this report, those in the beds have also come into bearing. As far as can be seen, the signs of disease have practically disappeared, but a careful inspection is being made of the fruit so as to note any return of it.

From experience gained by this experiment it would appear that planting flat in beds in three rows, 18 inches square, would be the most suitable distance. Planting on the banks has this drawback: that the plants are apt to give way with the weight of the fruit, having nothing near them for support. A sufficiently wide space should be left between the beds to allow for weeding and the picking of the fruit.

THE LIME INDUSTRY IN MONTSERRAT.

The Report on the Botanic Station, Montserrat, of the Imperial Department of Agriculture for the West Indies, contains the following account on the Lime Industry:—

The exports of lime products for the calendar year, 1911, are as follows:—

Fresh limes	5,183	crates	value	£ 363
Raw lime juice	102,597	gall.	,,	3,692
Concentrated lime juice ...	8,227	,,	,,	1,887
Citrate of lime	33	tons	,,	1,001

There are also 142 gallons of essential oil but as bay and lime oil are at present included together under the official returns, the quantities of each are difficult to obtain.

Some difficulty has been experienced in the lime industry through the presence of a disease which is associated with attacks of scale insects accompanied by black blight on the leaves and twigs, and with root symptoms suggesting the presence there of a fungus parasite. The matter is at present under investigation by the officers of the Imperial Department of Agriculture.

Below are given figures showing the extent of the lime industry over the last seven years, as indicated by the number of gallons of raw juice produced. Concentrated juice is reckoned at 9 to 1 and citrate of lime at 900 gallons of raw juice to ½ ton of citrate. These figures do not show that the returns are as yet affected by the conditions mentioned, as the number of gallons produced in 1911 is higher than in the two previous years, and at least represents an average crop.

The crop returns for the years 1905-11 are as follows:—

1905	...	245,112 gall.	1908	...	307,237 gall
1906	...	200,363 ,,	1909	...	220,122 ,,
1907	...	250,084 ,,	1910	...	200,241 ,,
		1911 ...	236,040 gall.		

PACKING FRUIT.

Mr. Albert Howard, Imperial Economic Botanist, Pusa, and Mrs. Gabrielle L. C. Howard, his personal assistant, have contributed an interesting paper on "Some Improvements in the Packing and Transport of Fruit in India" to the *Agricultural Journal of India*, from which the following conclusions are taken :—

1. Experience at Pusa and Quetta has shown that the present methods of growing and transporting fruits in India are exceedingly primitive, and that far better results in both these directions are easily possible.

2. In the plains, delicate fruit like peaches can be transported without damage, when practically ripe, by means of bamboo baskets containing small cells for each peach.

3. Non-returnable packages, made of wood and chip imported from Glasgow have been put on the market, at Quetta at prices within the means of Indian fruit dealers. By means of these packages delicate fruit like peaches, grapes and tomatoes can be sent to Calcutta, a distance of 1,750 miles, without loss or damage.

4. At present the ideal system of sending fruit on a large scale to distant markets is to adopt a suitable unit gift package, such as punnet, and to pack these in non-returnable crates. These units should be sold as such, direct to the customer.

5. All delicate fruit should be wrapped in paper. The most suitable packing material so far found is *san* fibre, obtained in pressed bales from Oudh.

BANANA JUICE AS A CURE FOR SNAKE-BITE.

A correspondent has forwarded us the accompanying extract from "The Over-Seas Daily Mail," indicating a remedy for snake-bite which is simplicity itself, and one within the reach of all living and working on our coast lands. Whatever may be the properties of the juice of the stem of the banana plant, it would seem from the newspaper extract that it has something in its composition which destroys the snake-poison. The alleged cures are certified by Mr. W. N. Weston, a resident of Matto Grosso, Brazil, as follows :—

I have witnessed some remarkable cures of bites from poisonous snakes while on a trip in the district of the Rio Taquary. One of these was an Indian peon, who was bitten in the foot by a "Yaraoca" snake. He arrived at the Estancia, apparently in the final stages, bleeding from the gums and all swollen up. A drink of banana juice taken from the *tree trunk* was given him, and in three days he was quite sound.

Another case was that of a child who was treated in the same way and recovered. I also saw the case of a bullock which was snake-bitten and seemed to be dying, unable to get up. We made an experiment by forcing it to swallow the juice. The swelling subsided, and next day the bullock was almost sound and able to graze.

There is no doubt it is a wonderful remedy, and I would be interested to know if any of your readers have heard of it and could tell me what properties the juice contains. —Queensland Agricultural Journal.

ANONAS.

MR. P. J. WESTER has written an interesting article on Anonaceous Possibilities for the Plant Breeder to the *Philippine Agricultural Review* from which we take the following:—

One of the most interesting groups of plants to which the plant breeder in the Tropics may devote his attention is the genus *Anona*, including some 60 or more species, and the closely related *Rollinia*, with over 20 species, belonging to the family Anonaceæ, of which an unusually large number of species bear edible fruits. There is also one species of *Duguetia* and some belonging to the genus *Uvaria* whose fruits are known to be edible. The papaw, *Asimina triloba*, is the only plant of this family in the Temperate Zone that may be considered as having possibilities for the plant breeder. Altogether, it is doubtful whether there is any other genus which contains so many species having edible fruits as the genus *Anona*. Already LINNE seems to have anticipated this when he created the genus, for the name *Anona* signifies "provisions;" it is not, as generally believed, derived from the pre-Linnean name "Anona," which, after LINNE, superseded *Anona*, in our days again being set aside for its older rival. Rumphius believed that "Anona" was a derivation of the Malay word Manoa or Menona, but NIEREMBERG, an older author states that the name Anona was applied to all Anonaceous fruits in Santo Domingo by the inhabitants. Considering that Oviedo already some two hundred years before Rumphius also referred to the sugarapple under the name "Hanon," sometimes spelled "Anon," there is but little doubt the name Anona is of American origin.

In connection with the fact that 9 fossil species of *Anona* have been discovered in Tertiary deposits in Europe, it is interesting to note that nearly all the Anonas and all the Rollinias so far described are indigenous to the New World.

A. cherimolia Miller (*A. tripetala* Ait.).—Cherimoya. A tall shrub or small tree, 4·5 to 10 meters high, with ovate-oblong, velvety leaves. The fruit is variable in size and appearance from that of a large apple to 5,000 grams in weight, irregularly heart-shaped, greenish or yellowish, ferruginous tomentose, areoles more or less distinct, carpids depressed, equal or raised; the flesh is whitish, sweet, subacid, rich, melting, and aromatic. The cherimoya succeeds best on well-drained land and is a native of Eucador, Colombia, Central America, and perhaps Mexico, but is now widely distributed throughout the Tropics and subtropics. The cherimoya is famed as one of the three most delicious fruits in the world. The extreme variability of this species is well illustrated in Plates II and III.*

A. crassiflora Mart. (*A. macrocarpa* Barb. Rodr.), (*A. rodrigueii*) Barb. Rodr.).—Marolo. A shrub or tree, with tortuous branches, 3 to 6 meters tall, indigenous to Brazil, where it grows from sea level to an altitude of 800 meters. The fruit is globose, conical, 13 to 14 centimeters in diameter longitudinally, yellowish green, ferruginous tomentose, areolate, with prominent carpels; the flesh is white, sweet, of agreeable flavour, and aromatic. The fruit is eaten raw and also used in making a drink. There is a variety of this species the pulp of which is yellow instead of white.

* Not reproduced.

A. glabra L. (*A. palustris* L.) (*A. laurifolia* Dunal).—Mamon. A tall shrub or a small tree of vigorous growth, sometimes exceeding a height of 7·5 meters, with oblong-oval or obovate, glabrous, leathery leaves. The fruit is cordiform, 6 to 12 centimeters long, moderately smooth, undulate, yellowish or brownish; the flesh is an attractive rich, creamy yellow, and barely edible. The mamon, indigenous to tropical America and Africa, is, together with the sugar-apple, custard-apple, and the sour-sop, one of the oldest known species in the genus. The mamon has been found to be a satisfactory stock for the cherimoya, the custard-apple, and the sour-sop, and appears promising for the biriba also.

A. muricata L.—Sour-sop. A small handsome tree, 4 to 6 meters in height, with oblong-ovate or obovate leaves, dark green and shining; fruit irregularly ovate-oblong or conical, attaining a weight of 450 to sometimes exceeding 5,000 grams, greenish, with short, soft spines; flesh white, rather fibrous, subacid, juicy, and well-flavoured. The sour-sop is a very refreshing fruit eaten raw, and it makes excellent sherbet and a grateful cooling drink. The species is indigenous to the West Indies from whence it has that of *A. punctata*, which will be presently considered.

A. reticulata L.—Custard-apple. A small, rather attractive tree, 4·5 to 7·5 meters in height, with lanceolate, papery leaves. The fruit is 7·5 to 15 centimeters in diameter, cordiform, surface fairly smooth, greenish or yellowish with reddish reticulations. The flesh is a creamy yellow, rich, sweet, and melting, with a slight trace of acidity. The custard-apple is indigenous to the American Tropics, but the species has long been well introduced throughout the entire equatorial belt.

A. senegalensis Pers. (*A. arenaria* Schum. & Thonn.), (*A. chrysophylla* Bojer.)—Anigli. A small shrub or tree, sometimes attaining a height of 8 meters, indigenous to a large part of tropical Africa from the coast and ascending the Ruwenzori to an altitude of 2,600 meters. The fruit of the better kinds is 4·5 centimeters in diameter, subglobose, surface yellowish to orange; the flesh is scant, but sweet and aromatic, and the fruit has by some travellers been very much lauded, while others have pronounced it valueless. The anigli is exceedingly variable and the following distinct subspecies have been described: *A. s. latifolia* Oliv., *glabrescens* Oliv., *cuneata* Oliv., and *subsessiliflora* Eng.

A. squamosa L.—Sugar-apple. A tall shrub, 3 or more meters high, with oblong-ovate leaves, thin, and sparsely hairy; the fruit is irregularly heart shaped, 7·5 to 10 centimeters in diameter, tuberculate, greenish; the flesh is white, sweet, and delicately flavoured, and the fruit is by some preferred to the cherimoya. The sugar-apple is indigenous to tropical America, and has become more widely dispersed throughout the Tropics than any other species in the genus. Ever since the discovery of these five species, the cherimoya, the sugar-apple, custard-apple, sour-sop, and mamon, they have been subject to an ever-increasing nomenclatorial confusion, the same popular name having been applied to two or more species with the inevitable result that even at this late day what is by one fruit grower considered to be a cherimoya is by another thought a custard-apple and by a third a sugar-apple, etc.

TOBACCO.

FLUE AND AIR-CURING PROCESSES OF TOBACCO.

MR. H. W. TAYLOR, officer in charge, Rustenburg Experiment Station, of the Tobacco and Cotton Division, Pretoria, has contributed an interesting article on The Production of Bright Tobacco by the Flue and Air-Curing Process to the *Agricultural Journal of the Union of South Africa*, from which the following are excerpts :—

ADVANTAGES OF THE AIR-CURING PROCESS.

Writing on the advantages of the Air-curing Process, MR. TAYLOR says the principal advantages of this process are that it requires less care and a smaller amount of labour than the flue-curing process. Where firewood is scarce the cost of air-curing is also considerably less. However the air-curing process has several disadvantages. With this method of curing the grower is more or less at the mercy of the elements. When climatic conditions are favourable some excellent "light coloured leaf" is produced, but when the weather is unfavourable the growers often sustain heavy losses. We have seen barns of air-cured tobacco in the Transvaal in which fully 80 per cent. of the leaf was either "yellow" or "light red," and we have also seen in the same season adjoining barns of tobacco, which had been grown on the same soil and treated in the same way, in which there was practically no yellow leaf, due to unfavourable weather conditions during the curing period. When cool, wet weather prevails for a week or ten days after the tobacco has been harvested, and more especially after the tobaccos have "yellowed," although the tobacco be grown on the most suitable soil it will cure a dark colour more often than "yellow" or "light red." On the other hand, if severely dry and windy weather is experienced immediately after the tobacco is harvested it will dry out too rapidly, and much of the green colour will remain in the leaf, thereby decreasing its value. Of course when closed barns are used much can be done to alleviate these unfavourable conditions. When the weather is too cool and wet for curing to properly proceed, charcoal fires will materially assist the process ; and when the weather is very dry the tobacco can be prevented from drying too rapidly by keeping the ground beneath the tobacco thoroughly soaked with water.

ADVANTAGES OF THE FLUE-CURING PROCESS.

Dealing with the flue-curing process, MR. TAYLOR remarks that the advantages this process has over air-curing are numerous. In the first place, a higher percentage of "yellow" leaf can be obtained—the grade which commands the highest price on the market. Then, flue-cured tobacco has a more pleasing odour and flavour than air-cured tobacco, hence leaf of the same colour will command a higher price when flue-cured. By using artificial heat in a tight shed the tobacco is not subject so much to climatic changes during and after curing ; then in a dry climate, such as we have in South Africa, the tobacco

which is harvested late in the season and placed in the ordinary air-curing barn must hang until the rains of the following season before it can be prepared for market, unless special provisions are made for moistening it. Being thus exposed to the severe winds considerable loss occurs, and the farmer must wait several months for the money from that portion of his crop. When tobacco is cured in a flue-barn it can be moistened and immediately taken down. This process will be explained later. More tobacco can be cured in a flue-barn than in a barn of any other type which costs the same amount of money.

FLUE-CURING BARNS.

Flue curing barns are built small. The size is 16 feet square (inside measurements) by 20 feet high. We are often asked why the barns are built larger. The reason is that the shed must be filled in one day, and a barn of the above dimensions can be readily filled in one day by the labour found on the average farm. Again, tobacco cures a more uniform colour in a small barn than in a large one, as it is much easier to maintain a uniform heat.

The width of a curing barn should always be some number of feet which is divisible by four, allowing space for the tier poles, since the tier poles—upon which are placed the laths carrying the tobacco leaves—are placed 4 feet apart. A barn of the above dimensions would be divided into four rooms, each of which should contain six tiers, thus making twenty-four tiers in the barn each 16 feet long. A "tier" is the horizontal space between two tier poles or deals and a "room" is the vertical space included between two sets of tier poles extending from the bottom to the top of the barn. A barn 16 feet square inside and 20 feet high may be described as a four-room or twenty-four tier barn. When filled, a barn of the above size will hold about as much tobacco as can be grown on one-half of an acre. The barn can be filled three times each month, so that about one and one-half acres of tobacco can be cured in each barn per month.

TURKISH TOBACCO IN THE CAPE PROVINCE.

By L. M. STELIA.

OFFICER IN CHARGE, TURKISH TOBACCO EXPERIMENTS, STELLENBOSCH.

HISTORY.

In 1903 the writer purchased a small farm in the French Hoek Valley. The farm was all in bush in the beginning, but when a small area had been cleared during the second year and put under cultivation we decided to give Turkish tobacco a trial. Being unacquainted with the climatic conditions we followed minutely the Turkish methods so far as the curing was concerned, but the first crop, though very small, was a complete failure. Nevertheless, this did not discourage us, and we pursued our experiments more vigorously. In 1905 we began studying the climatic conditions, and after that our experiments were a complete success.

The area under cultivation was 1½ acres, and the yield was 1000 lb. We were unacquainted with the South African market, so when we were, offered 1*s.* per lb, for the crop we accepted it. The price seemed ridiculously low, for the actual cost of producing the crop was 11*d.* per lb., as we had to deal with raw and inexperienced labour and had many other drawbacks. We were told that the highest price ever paid for the best South African tobacco was 10*d.* per lb., and that we should be highly satisfied with the offer. After closing the transaction on inquiring elsewhere we were offered 2*s.* 6*d.* per lb. for the crop. This manufacturer was in earnest, for he wanted to enter into a contract with us to deliver to him 60,000 lb. of a similar article the next season at 2*s.* 6*d.* per lb. This encouraged us to undertake Turkish tobacco growing again. The manufacturer in question was MR. HERMANN of the firm of HERMANN & CANARD, Capetown. Great credit is due to him for the prompt action he took in helping to make the industry an accomplished fact.

After seeing samples of this tobacco he introduced me to the officials in the Agricultural Department, and explained that he foresaw a great industry ahead of us. He insisted that the Government should lose no time to foster same. The result of the interview was that the Government secured the writer's services, and since then Turkish tobacco has become the staple crop on more than eighty farms, all of which have been successful in the production of this type of tobacco.

COST OF PRODUCTION AND YIELD PER ACRE.

The approximate cost of production per acre is £15.

An acre of land will yield about 600 lb. of tobacco when the season is good, and valuing this at 1*s.* 6*d.* per lb. the total profit would be £45, thus the net profit per acre would be £30. A few exceptionally good crops have almost doubled this figure.

The maximum yield per acre of Turkish tobacco has been about 1000 lb. and the minimum yield 300 lb.

SEED.

Owing to the want of a Turkish tobacco experiment station in the Cape Province no steps so far have been taken to breed and select our own tobacco seed, consequently we have been compelled to import fresh seed from Turkey each year.

PREPARATION AND TREATMENT OF SEED BEDS.

The preparation and treatment of the Turkish tobacco seed beds are more or less similar to that applied to the American types. The seed is sown at the rate of 1 ounce per 100 square yards.

SOILS.

The best soils suitable for Turkish tobacco are those of a reddish friable nature, with about 30 per cent. of clay. Gray and yellow sandy loams give good results. Decomposed granite formations also give excellent results, particularly so far as the combustibility of the leaf is concerned.

MANURING AND TREATMENT OF SOIL.

New lands are preferable, especially when ploughed one year ahead and allowed to remain fallow. Pests cause very little trouble to the crop on such lands. Sheep manure, in our opinion, for Turkish tobacco is the best,

provided it is given sufficient time to allow the subsequent rains to dissolve the plant food which it contains. The manure is pulverized and scattered broadcast at the rate of 6 tons per acre and immediately ploughed under. During the interval between the first, second, and third ploughings the land should be harrowed and kept free from weeds. Shortly before setting out the plants the land is reploughed and harrowed. Fertilizers have also given good results, especially where lands had been manured with sheep manure the previous year. When fertilizers are applied in drills it is usually at the rate of 300 lb. superphosphate, 160 lb. sulphate of potash, and 130 lb. nitrate of soda per acre.

Experiments have also been conducted with Karroo ash and Government guano. The usual dressing broadcast per acre is as follows : 1½ tons Karroo ash and 800 lb. Government guano. A lighter application of Karroo ash and Government guano has been tried. It was applied in the drills at the rate of 800 lb. ash and 200 lb. guano. This also gave good results, and the actual cost was 18*s.* per acre. Such cheap dressings as the last mentioned are not recommended, for the reason that it impoverishes the soil—unless it has been manured the previous year. Karroo ash and guano are applied separately.

No experiments with rotation of crops have been tried in connection with Turkish tobacco, but the farmers have been strongly advised to adopt a rotation system.

TRANSPLANTING.

The method of transplanting Turkish tobacco plants is similar to that of the American types, the only difference being that the plants are set much closer together in the rows—8 inches to 9 inches apart, and the distance between the rows is 2 feet 6 inches to 3 feet. Instead of making ridges a shallow drill 2 inches deep is cut. This drill serves as an indicator and also retains the water, which is important, as most of our tobacco fields are situated on the slopes of the mountains.

TREATMENT DURING GROWTH.

When the plants have been established the soil round them is loosened by means of forks, or, where the soil is of a sandy nature, by means of a Planet Junior hand-machine. The horse-hoe is used when the plants attain a height of about 1 foot, and this operation is repeated after each rain until time for priming.

TOPPING AND SUCKERING.

With Turkish tobacco no topping is necessary. If the flower head is not disturbed very little trouble is caused by suckers, unless heavy rains are experienced ; then, in that event, they are removed, as they have a tendency to cause deterioration in the quality of the tobacco.

PRIMING.

When the flower head is formed the extreme lower leaves show signs of ripeness. Four or five of these leaves are picked, removed from the field, and destroyed, as they are as a rule affected with *Lita solanella*, commonly called "potato tuber moth."

PICKING THE LEAF.

The leaves are picked early in the morning. The reason for picking at this time is that they are brittle, and therefore it damages the stalk less, and the fine dew on them helps to keep them cool, consequently they wilt and turn yellow better in the wilting-room. The leaves are placed in baskets or boxes and conveyed to the threading-room, where they are graded according to size and threaded on strings fastened to rods, which are usually 7 feet long.

WILTING.

After the tobacco is threaded it is transmitted to the wilting-room, where it remains about four days so as to change its colour. The room is kept closed during the day and opened during the night. The temperature is kept to about 70° F.

DRYING.

The tobacco, after it has passed its wilting stage, is transferred during the morning of the fifth day to the curing camp, where the rods are suspended about 2 inches apart on trellises. The first day they are covered with sheets of canvas so that they do not scorch. The covering is repeated the second day should the weather be extremely hot. The third day the rods are shifted from their position to about 4 inches apart, the fifth day 5 inches apart, and the sixth day 6 inches apart. The idea of shifting the rods daily is to prevent the tobacco from drying too rapidly. The tobacco is covered every night to protect it from dew, and is opened in the morning about an hour after sunrise. It remains on the trellises about ten days, and it is then transferred to the ground on clean sheets of canvas, each rod singly, and allowed to remain thus during the day, but it is covered at night. The next morning the rods are turned, exposing the other surface of the leaves to the sun. This is repeated daily until the midribs of the leaves are perfectly dry In the morning the tobacco is then removed to the shed and stacked on a platform which has been built about 1 foot from the ground. If the atmosphere is very dry the canvas is removed early in the morning to allow the tobacco to become pliable. The stacks are covered so that the tobacco can retain its moisture and improve in condition. The stacks are carefully watched lest the tobacco may damage with an excess of moisture. If the tobacco is stacked with very little moisture the stacks are broken down once a fortnight and restacked again, but if it is stacked with more moisture than it should possess it should be taken out and dried a bit to reduce the moisture, else it will become mouldy.

The restacking of the tobacco once a fortnight not only improves the colour, but distributes the moisture evenly.

PREPARATION FOR BALING.

Before baling, in case the tobacco is very dry, the rods are laid down flat and the tobacco sprayed gently on one side with water. A knapsack spray pump, having a Vermorel nozzle, is the most convenient appliance for spraying. The tobacco is then stacked, keeping always the damp part upwards so as to divide the moistured with the unsprayed part. By this means the whole mass becomes soft and elastic. Two days after the tobacco has been sprayed it is restacked. While the tobacco is being restacked if any parcel contains too much moisture it is hung in the sun and partially

dried to reduce the moisture. It is advisable to allow the stacked tobacco to remain at least one week before it is baled in order that the moisture may be evenly distributed. It is then graded into three grades, viz., bottoms, middles, and tops.

BALING.

Baling is undertaken at any convenient time after the conclusion of the drying process. The strings are cut from the supporting rods at each end and folded in such a way as to correspond to the size of the box. The butts are turned outwards and the tips towards the centre. If too much pressure is applied the leaves stick together and cause great inconvenience to the operators at the warehouse. The usual weight of a bale of Turkish tobacco is about 80 lb. The bale is sewn up in canvas with the ends showing the butts of the leaves exposed. At the ends the canvas is laced together criss-cross like a widely laced boot. The bales are then marked and sent to the warehouse where they receive further treatment.—AGRICULTURAL JOURNAL OF THE UNION OF SOUTH AFRICA.

DHALL FROM CEYLON.

A sample of dhall (*Cajanus sp.*) was received from Ceylon in May, 1911. It consisted of small, rounded, rather flattened seeds, light yellowish-brown to purplish-brown in colour, dry and fairly sound; 5 per cent. of those examined were damaged by weevils.

The sample was fairly free from dirt, only a small amount of husks and other debris being present.

The seeds were submitted to chemical analysis with the following results:

	Per cent
Moisture	10·64
Crude proteins	20·11
Consisting of:	
True proteins	19.87
Other nitrogenous substances	0·24
Fat	1·10
Starch, etc.	57·88
Fibre	6·9
Ash	3·37
Nutrient ratio	1 : 3·0
Food units	110·9

The seeds contained no alkaloid, saponin, or cyanogenetic glucoside.

The dhall was submitted to brokers, who considered that it would be worth about £6 10*s.* per ton in London (October 1911).

The results of the analysis of this sample agree fairly well with the figures previously recorded for dhall.—IMP. INST. BULLETIN.

SPICES.

ALLSPICE OR PIMENTO.

The spice known as Allspice or "Whole-spice," Pimento, or "Jamaica Pepper" is the product of a small tree known botanically as *Pimento officinalis*, belonging to the natural order Myrtaceæ. It is a small tree with smooth greyish bark, 25 to 30 feet high, native of the West Indies and Central America. The dried unripe berries, which are of the size of small peas and of a glossy black colour when ripe, are the allspice or pimento of commerce. The name "allspice" is due to a supposed resemblance of the spice to a combination of the odour and flavour of cinnamon, nutmegs and cloves. The tree was introduced into Ceylon early in the last century, and has become established at Peradeniya, where it flowers in the dry weather and usually produces a small crop of fruit; but outside the Botanic Gardens it is rarely met with in this country. Unlike its native habitat, here the tree shows no tendency to become self-planted by the dispersal of the seeds by birds. Possibly Ceylon birds have not yet developed a taste for them. The tree is considered to yield best in a hot and rather dry climate, preferring a loose, loamy or alluvial, well-drained soil. The berries are picked while green, but just ripe, and are then dried in the sun, the latter process taking six to ten days. The fruits are known to be sufficiently dry when they become black in colour and when, on shaking, the seed rattles inside. The process of gathering is effected by a long stick with a crook at the end, the fruit-bearing clusters being broken off and thrown down, and the berries then picked off the stalks by women and children. An allspice tree under favourable circumstances begins to bear when 7 or 8 years old, but it is not usually in full bearing until it reaches the age of about 18 or 20 years, when a single tree may yield as much as 1 cwt. of the dried spice. Jamaica is the only country at present that exports this spice, and its annual export varies from 9 to 12 million pounds or more: the average price realised in the Island is about 15/- per 100 lb., though sometimes it is as much as 30 shillings for the same quantity. The market price in England is about 2½*d.* to 3*d.* per lb. Pimento oil, which is obtained by distillation from allspice leaves, it is imported into London and sold for about 2*s.* 9*d.* to 3*s.* 6*d.* per lb. Added to rum, this makes the beverage known as bay rum.

H. F. M.

Photo. by H. F. Macmillan

ALLSPICE TREE. Pimento officinalis

PEPPER IN SIAM.

Only two kinds of commercial pepper are recognised in Siam—white and black. Nevertheless, of late years it has become the habit in some provinces to distinguish four qualities of black pepper; the first consists of only perfect seeds, round and full, and the fourth of small or broken seeds and fragments, the second and third being intermediate. The following tables give the average price of pepper at the place of production for the year 1911-1912.

	ticals per picul	pence per lb.
White pepper ...	56	$7\frac{3}{4}$
Black pepper : 1st quality	36	5
.. .. 2nd ,,	32	$4\frac{1}{2}$
.. .. 3rd ,,	23	$3\frac{1}{4}$
.. .. 4th ,,	13	$1\frac{3}{4}$

The tax on transit in the interior is 1·25 tical per picul (about $1\frac{3}{4}d.$ per 10 lb.) in the case of white pepper, and 1 tical per picul ($1\frac{1}{2}$ per 10 lb.) for black. In 1911-1912 (the Siamese year begins on the 1st of April) the total export of pepper from Siam was 34,270 piculs (4,569,300 lb.), worth 1,193,297 ticals (£919,933). The port of Bangkok exported 24,200 piculs worth 921,174 ticals (£710,072), while Puket exported 10,003 piculs (133,700 lb.), worth 271,827 ticals (£209,544). The chief buyers of Siamese pepper are England (13,093 piculs=1,754,700 lb. in 1911-1912) and the United States (2,291 piculs=305,460 lb. in 1911-1912. During the same year, 4,677 piculs (623,500 lb.) were sent to Singapore and 2,367 piculs (315,600 lb.) to Hong Kong.—MONTHLY BULLETIN.

FIBRE AND OIL IN HAWAII.

DR. E. V. WILCOX, Director of the Hawaii Experiment Station, has recently sent to a firm of paper manufacturers in the United States a supply of pine-apple leaves, and this firm has made a favourable report on the fibre produced from them. It is found suitable for a kind of tough paper used for insulating purposes. It has been proved that the fibre can be produced with the machinery for making sisal fibre. Seventy pounds of fibre to the ton of pine-apple leaves can be produced, which at 14 tons of leaves would be 1,000 lb. of fibre to the acre. At a profit of only one halfpenny a pound this means £2 an acre for what is now waste. DR. WILCOX is stated also to have received reports from manufacturers of varnish in various cities, upon sales of kukui-nut oil sent from the Hawaii Experiment Station. They are to the effect that it is far better than linseed oil for making varnish. Honolulu at present imports 50,000 gallons of linseed oil each year. Experiments are being made to produce a press to extract the oil.—JOUR. OF THE ROYAL SOC. OF ARTS.

POULTRY.

EYE WORM OF CHICKENS.

MESSRS. E. V. WILCOX and C. K. MCCLELLAND have jointly written an article on the Eye Worm of Chickens in Press Bulletin No. 43, issued by the Hawaii Agricultural Experiment Station, Honolulu, from which it appears that the investigations reported in the bulletin that the eggs of the eye worm of chickens are either laid in the eye, from which they are immediately washed into the throat by the flow of tears down the tear duct, or are set free in the intestines by the disintegration of mature female worms which had passed down the tear duct, through the throat, into the intestines. The eggs hatch for the most part or altogether in damp soil, where they live until they attain at least one-third of their mature size, and then again entrance to the eyes of chickens directly from the soil. The best treatment for the destruction of the eye worms in the eyes of fowls consists in anaesthetizing the eye with a 5 per cent. solution of cocaine and then lifting the nictitating membrane and dropping a 5 per cent. solution of creolin directly into the inner corner of the eye, under the nictitating membrane. The fact that soil contaminated with the feces of infested fowls contains thousands of the larvæ of the eye worm makes it obvious that means should be taken to destroy the young worms in such situations. This may be accomplished by applying quick lime and keeping the soil as dry as possible, and also by the frequent cleaning and removal of all feces from infested yards, or in the case of bad infestations, by keeping the birds on dry floors which can be frequently cleaned until the infestation has disappeared.

THE UTILITY POULTRY CLUB'S TWELVE MONTHS' LAYING COMPETITION.

The eighth period of four weeks of the competition ended on May 27th. During May there was again a decrease in the number of eggs laid, the total being 9,520 as compared with 10,684 in the preceding month. Broodiness was still very prevalent, and was no doubt responsible for this falling off.

The premier position in May was taken by Pen 60, White Wyandottes. which at last gained the lead in spite of one bird being broody. Its record up to May 27th was 840 eggs (value £4 5*s.* 9½*d.*). Pen 86, Buff Rocks, which dropped to second position, did not by any means maintain its standard of laying. Broodiness did not claim any of the birds, so that its loss of position was due to a general failing off. Its record was 785 eggs (value £4 5*s.* 7*d.*). Pen 32, White Wyandottes, retained third position, with a total score of 791 eggs (value £3 18*s.* 2*d.*). The fourth position was held by Pen 45, White Wyandottes, which laid a total of 729 eggs (value £3 12*s.* 9*d.*).

This pen will have to make considerable headway before it is able to gain an improved position. Fifth place, which in April was held by Pen 24, Black Leghorns, was in May, taken by Pen 35, White Wyandottes, with a total of 738 eggs (value £3 11*s*. 6½*d*.). This pen rose from seventh place to fifth. Pen 24, Black Leghorns, followed with a total score of 706 eggs (value £3 11*s*. 5¾*d*.).

The only pen of Red Sussex held a creditable position, viz., sixteenth. This is probably the first occasion in a competition where this breed has done so well. The highest pen record for the month was again made by Pen 62, Silver Laced Wyandottes, which laid 131 eggs (value 10*s*. 0½*d*.).

Health continued good, and the general appearance of the birds was satisfactory.—BOARD OF AGRIC. JOURNAL.

EGG-LAYING COMPETITIONS IN THE RHINELAND.

The Chamber of Agriculture for the Rhineland has during the last three years conducted egg-laying competitions for poultry lasting ten months in each year, from November to August, at its special grounds. The results of the first two years work are given in the present report. The first year 210 one-year-old hens were tested and in the second year 210 two-year-old hens with few exceptions in both competitions the same birds were used. Each of the six breeds examined were represented by seven families, each consisting of five members.

The comparison between the total yield of the one-year-old birds and that of the two-year-olds is considerably in favour of the former. During the ten months that the competition lasted the one-year-old hens laid 125 eggs (worth 11*s* 3¼ *d*), the two-year-olds 102·4 eggs (worth 8*s* 7¾ *d*). The eggs laid in winter by the latter were only 54·71 per cent. of those laid by the former.

The following are the scores of the various breeds :

Breed	Average number of eggs laid	
	One-year-old hens	Two-year-old hens
Black Rhenish	104·7	124·1
White Wyandotte	130·7	99·3
Black Minorca	126·5	99·6
Partridge Italian	121·0	103·7
Buff Orpington	119·8	92·1
White Orpington	111·3	95·5

The small breeds have thus proved more productive than the medium-sized ; nevertheless the difference was not so marked among the one-year-olds as among the others. As for their behaviour during the various periods of the competitions the small and medium breeds gave one-third of the total yield during the first five months. The maximum number of eggs

laid by the small breeds was in May for the one-year-olds and in April for the two-year-olds, while that of the medium-sized breeds was in both cases one month earlier.

The writer then compares the yields of the best and the worst families and finds that in both competitions the Rhenish and the Italian breeds show the most uniform results. The Minorca families showed also in the first competition considerable uniformity, but less in the second. Among the medium-sized breeds the yields of the various families were very different and this the writer attributes to the still incomplete improvement of the breeds.

Lastly, concerning the weight of the eggs, the heaviest were those of the Minorcas (2·20 oz.) and of the White Orpingtons (2·11 oz.); the lightest were the Italians (2·03 oz.) and the Rhenish (1·98 oz). The best layers accordingly produce the lightest eggs. The eggs laid by the one-year-olds were on the average 0·08 oz. lighter than those of the two-year-olds.

The writer reports upon the money value of the eggs and gives some advice on the keeping of egg-laying poultry.

IRISH EGG-LAYING COMPETITION.

The pullets arrived at the place of competition on September 13, 1912, and the contest began on October 1.

Taking into account that this was the first competition held in Ireland, and that most of the competitors were novices at selecting birds for such a contest, the quality was very fair, and though too early hatching, immaturity and bad condition were apparent in some of the exhibits, only two birds died, and the health of the birds remained good in spite of the bad weather in December. The leading pens were all in splendid condition on arrival.

The foods used were oats, maize, wheat, pollards, thirds, bran, linseed meal, meat meal, cut clover, hay, cabbage and milk. A supply of grit and shell is always available and the birds have water both inside and outside the house.

The writer gives a table showing the position of the different breeds, as regards the number of eggs laid, as well as the price obtained for the latter.

The number of eggs laid by the 10 best pens was as follows :—

1.	Red Sussex	296
2.	White Wyandotte	293
3.	Buff Orpington	244
4.	Rhode Island Red	231
5.	White Wyandotte	203
6.	Buff Orpington	199
7.	Rhode Island Red	195
8.	Brown Leghorn	191
9.	Rhode Island Red	189
10.	Rhode Island Red	188

—MONTHLY BULLETIN.

APICULTURE.

HINTS ON BEE-KEEPING.

The bees commonly kept for honey are the different strains of the Western bee (*Apis mellifica*) and the Eastern bee (*Apis indica*).

For many reasons it is better to start bee-keeping with indigenous bees.

If you want a well made good box-hive you could get one for Rs. 9/- from the Secretary, Ceylon Agricultural Society, Peradeniya.

If you prefer to get one made for yourself the Secretary will be glad to send you specifications. Having secured a box look out for a swarm which is usually found clustering on the branch of a tree. Place a box underneath the swarm and jerk the bees into it. Then turn the box upside down and raise one edge so that the bees could go in and out. The box may now be taken to the hive prepared for them, and the bees jerked on to the alighting board, from where they will enter the hive, which should be kept slightly raised off the board to allow of free entrance.

Bees are not inclined to be vicious when swarming. To induce the bee to remain, the queen should be captured and her wings clipped, but this is not generally necessary. It is best for a beginner to start by getting a hive colonised for him.

Care should be taken to place the hive perfectly level on a stand about 2 feet from the ground and make it face the east.

Beginners may wear a veil and gloves to save them from stings, but with coolness and care these precautions could be dispensed with and manipulation is all the easier. The great thing to remember is not to jar or jerk the hive or frames in handling and not to hurry. It is frequently necessary to prize off the top lid and for this a screw driver is useful. Always approach the hive from behind. After lifting the cover lay it in front of the hive so that any bees may run inside. If the frames are sealed by wax use the screw driver to move them before lifting. This should be done carefully. If the bees are much disturbed it is best to leave them alone for a while.

Watch for signs of swarming which is the means by which bees increase and spread. When the hive is too full the bees become restless and decide to divide. For this purpose they raise one or more queens and when they are about halfgrown the old queen leaves the hive with about half the colony, leaving the rest to take care of the young queens. Keep one or two empty hives ready to receive new swarms.

This induces the bees to store honey in a "super" that is a second hive placed on the original one.

C. D.

Photo. by C. Driceberg.

BEE HOUSE AT THE GOVERNMENT STOCK GARDEN.

LITSEA CHINENSIS AND BITTER HONEY.

At the Government Stock Garden Bee house some excellent comb honey was got in July, but the honey was of a bitter flavour which was traced by the Foreman of the Stock Garden to the flowers of *Litsea Chinensis*, two specimens of which were found growing on the premises.

Litsea is a genus belonging to the order Lauraceæ, and the wood of the species *Sinensis* is used for building. The most interesting point however about the tree is the medicinal properties possessed by the bark, which is used externally in the treatment of fractures, bruises, &c. In this connection the following extract from A. M. & J. Ferguson's "All About Fibres, Drugs &c" is much to the point:—

"There is a tree growing in the Patchelapalla district, in the Northern Province, the Tamil name of which is Elamboreka, literally translated "bone-setter." The medicinal properties reside in the bark, and the native doctors are accustomed to apply the pounded drug in the shape of poultice to a broken limb, for the space of about twenty minutes, or as they calculate for the time a pot of rice takes to boil, when it is removed and the limb bound up in the confident expectation that the several parts will unite without further trouble. Fabulous stories are told, as a matter of course, of the virtues of this remedy, but a case came under my own observation which may as well be stated. A Sinhalese, aged about fifty, was brought to Mr. Simon Casie Chitty, late Judge of Chilaw, having been picked up on the road side where he was left by robbers. They had beaten him with sticks until his arm was smashed from shoulder to wrist, and the Judge was for calling in at once the Sub-Assistant Surgeon, but the man declined the offer with somewhat of scorn. He was, he said, a Vederala (doctor) himself and could set his arm to right. Fortunately for him there happened to be a solitary Elamboreka tree in the jail compound, and he had the bark of it applied in the manner above detailed. It seemed impossible that he could escape amputation, but two months afterwards he was in the field, superintending his labourers, with a sound and apparently strong limb. For the truth of this statement I can vouch, having seen the battered arm, and also seen the man after recovery."

The Sinhalese name of *L. Sinensis* is Bomi and the Tamil name, Elumpurukki.

C. D.

SUDD FOR PAPER PULP.

Economists have for some years been busy with the sudd problem of Upper Egypt. The vast papyrus-covered areas of the swampy region of the Nile contain billions of tons of vegetable fibre which, when properly handled, can be utilized for either fuel or paper pulp. This sudd is a sort of spongy peat and, when properly bleached, ground and pressed, can very probably be turned to good account in helping to relieve the excessive demand on the timber forests. Recent experiments in England have gone so far as to leave only a little doubt as to the commercial success of this venture.—Philippine Agricultural Review.

AGRICULTURAL COLLEGES ABROAD.

The following accounts on the Agricultural Colleges of Cirencester and Wye are taken from Leaflet No. 197 issued by the BOARD OF AGRICULTURE AND FISHERIES:—

ROYAL AGRICULTURAL COLLEGE, CIRENCESTER.

This institution is intended to provide a course of instruction, both scientific and practical, suitable for land-owners, land agents, agriculturists, intending colonists, etc. The College is associated with the University of Bristol.

The course for the College diploma extends over three years. In addition there are a one-year course for older men, a Colonial course of one year, a Winter School of eight weeks, and courses for the B.Sc. (agriculture and forestry) degrees of the University of Bristol. The fees for in-students are £45 to £55 10*s.* per term, and for out-students £25 per term, with an entrance fee of £5. Several scholarships are awarded at the College.

The College holdings cover 50 acres and the neighbouring farm which is available for practical instruction extends over 500 acres, of which about 300 are arable and the remainder pasture. An area of 3,000 acres of woods, the property of LORD BATHURST, a forest garden of 10½ acres, an experimental area at Colesbourne, and two forest nurseries are available for instruction in forestry.

SOUTH-EASTERN AGRICULTURAL COLLEGE, WYE.

The agricultural instruction at this College is arranged in three courses:—(1) The London University B.Sc. course, extending over four years after matriculation; (2) the diploma course, extending over three years; and (3) the certificate course (agriculture and commercial fruit-growing) of two years. The mornings are allotted to lectures and laboratory work, and the afternoons are occupied by various practical classes on the farm, the fruit and hop plantations, the dairy, poultry-yard, etc. Lectures are given in the evening.

The inclusive fee for board and tuition is £120 a year; for tuition only £70 a year; and for a limited number of students resident in Kent and Surrey £60 a year, including board and lodging, or for tuition only, £15 per annum.

The College farms consist of about 460 acres, of which 176 are arable and the remainder pasture, gardens, buildings, etc. The sheep kept are chiefly pure-bred Romney Marsh and Southdowns; there is a herd of Shorthorns, as well as Aberdeen-Angus, Galloways, Red-Polls, Herefords, Sussex, and other breeds. Four breeds of pigs are also kept, and representatives of the three principal breeds of farm-horses are used on the farms.

A hop garden of 7 acres has been laid out, showing different systems of training hops. Commercial fruit-growing receives special attention, and instruction is also given in market-gardening and flower-growing, $16\frac{1}{2}$ acres being devoted to horticulture. A small area is devoted to the French system of raising vegetables. A series of demonstration plantations and a nursery for forest trees are being established to enable practical instruction in forestry to be given.

AGRICULTURAL EDUCATION IN THE TROPICS.

By C. F. BAKER.

(Continued from p. 157).

Finally, from among the graduates of the agricultural college are chosen those few of especial fitness and capacity to be sent abroad by the general government for still more advanced training in the best foreign schools. Such men, on their return, can then be used in government bureaus, experimental stations, and in the constantly-growing agricultural college itself, as well as among the normal and high schools. The greater number of the graduates will return to their home districts trained agriculturists, to teach in the schools and to manage plantations and farms. In either case they will form an active and widely-distributed leaven, since every one going into active agriculture will be operating what is, to all intents and purposes, a demonstration farm. Within a few years of active operation of the agricultural college, hundreds of its graduates become distributed throughout the country, and the chances for the rapid introduction of new methods, new crops, new machinery, and new hopes become greater than would be possible by any other means. It is really a revelation for one who has not been here before, to see the work being accomplished in the College of Agriculture of the Philippines—to step into a first-class modern chemical laboratory and find there a large number of keen well-trained students representing all the principal tribes of the Philippines analyzing soils, plant products, and fertilizers, to see them working with microscopes and physiological apparatus in the botanical laboratory, to see them surveying and levelling in the fields, taking charge of field cultures and experiments, and in all directions working out results that would be a credit to agricultural college students anywhere. It all gives strong assurance of the practical possibilities in development along these lines in the tropics. Even here in the Philippines, the work is yet very young, and is being rapidly strengthened and perfected in innumerable ways. The day must come, and that soon, when the majority of tropical countries have such institutions well organized, fully equipped, and in active operation.

The site of an agricultural college in the tropics is a matter of primary importance. The great tropical crops like rubber, cane, corn, cacao, tobacco, coffee, coconuts, rice, spices, fibres, and so on, are very varied in their requirements, so that varied conditions and topography in the college farm are a prime essential. Where this is not possible within the limits of a single farm even though it be sufficiently large, the conditions may often be obtained in

several closely-connected stations. A location at the foot or on the slopes of a mountain, with irrigable lowlands near at hand, and higher and varied country just above, with abundant water supply, make ideal surroundings for the college plant. No greater mistake can be made than to locate it within city limits, both for the sake of the students and of the work, or to place it in any locality suitable to only a limited class of cultures. Nor should the size of the farm be too limited. There should be ample space for the Animal Industry work, in pastures, pens, and feeding lots. Permanent tree plantings of great variety must be made, for instance in coffee, cacao, coconuts, citrus, and other fruits, arranged both as to variety and in contemplation of extensive comparative fertilizer and other tests; and all these require space. There is a large class of semi-permanent cultures including certain fibres, cane, and various tropical root crops, and these also require ample space under varied conditions. Finally there are the many annual cultures of every description which must find accommodation. The farm is pre-eminently the most important laboratory in the college. Without it the college would be like a medical school without hospital or clinic, or a law school without the courts. Students *must have* practical work and opportunities for technical investigations in all the standard tropical crops, and *with all phases of their handling*, else the very purpose for which the college was founded becomes unattainable, and its results impractical and ineffective.

The animal industry department should possess small herds of all the domestic animals deemed possibly adaptable to the climate and conditions involved, with sufficient numbers for breeding, dairy work, feeding experiments, and for carrying on the current work of the farm. A course in the simpler phases of veterinary science and farm sanitation is one of the essentials in agricultural training, and this is particularly and especially true in the tropics where animals can be kept in health and vigour only by adequate knowledge and eternal vigilance.

The machinery used in tropical agriculture in connection with the handling of coffee, cacao, fibres, rubber, cane, rice, corn, and other crops, is mostly the development of very recent years. Small, or unit, forms of these should be installed on the farm and kept in working order. It is immaterial whether crops be at hand at the time for their employment or not. Every student should be familiar with every working part of them, and should himself operate them, oil them, dismount and remount them, and know thoroughly the principles on which they work. The work with machinery requires a trained instructor who is a practical machinist and who can also have charge of elementary instruction in the use of modern farm tools, as well as have charge of the upkeep of the entire equipment in this direction. A small blacksmith and repair shop will be a necessary item in this department.

The work with fertilizers should be especially complete and comprehensive, and to this end abundant stores of all available manures should be constantly on hand, and in constant use by the students.

The work in rural engineering, covering, surveying, levelling, farm constructions, sanitation, irrigation and drainage should be thorough and very practical, and this requires a trained engineer, who should also be instructor in physics and necessitates likewise ample equipment.

SOILS AND MANURES.

STERILIZATION OF SOIL.

The writers have by these further experiments confirmed and extended the results reached in their previous paper. Fresh evidence is adduced that bacteria are not the only inhabitants of the soil, but that another group of organisms occurs, detrimental to bacteria, multiplying more slowly under soil conditions and possessing lower power of resistance to heat and to antiseptics.

In consequence of the presence of these detrimental organisms, the number of bacteria present in the soil at any time is not a simple function of the temperature, moisture content and other conditions of the soil. It may indeed show no sort of connection with them, thus rise of temperature and increase of moisture content are found to be ineffective in increasing the bacteria in the soil. The number of the latter depends on the difference of activity of the bacteria and the detrimental organism.

Partial sterilization leaves the former unharmed, but kills the latter, as do antiseptic vapours or the heating the soil to 55 or 60° C. Whenever the treatment is sufficiently energetic to kill the bacteria, these micro-organisms rapidly increase as soon as the soil conditions are made normal. Once the detrimental organisms are killed, however, the only way of introducing them again is to add some of the untreated soil, but the precise conditions governing the transmission are unknown.

The writers provisionally identify the detrimental organisms of the soil with the active protozoa of the latter, but as the zoological survey is yet incomplete, they do not commit themselves to any definition of the term protozoa, nor to any particular organism, or set of organisms.

As there is a great diversity of opinion on this point it may be well to mention some of the experiments made by the writers, who in all their sterilization operations, always sought for and obtained protozoa. The soil is inoculated into a one per cent. hay infusion and left in an incubator at 25°C for 4-5 days, examination being made periodically for protozoa; these are roughly grouped as ciliates, amœbæ, and monads. Partial sterilization simplifies the fauna considerably, killing the ciliates and amœbæ but often leaving certain monads. Whenever the ciliates and amœbæ were killed, the investigators invariably found that the detrimental factor was extinguished; whenever the detrimental factor was not extinguished, the protozoa also were not killed.

The following are typical results for heated soils :

	Bacteria after 68 days. Millions per gram of dry soil	Ammonia and nitrate formed after 68 days. Parts per million of soil	Detrimental factor	Protozoa found
Untreated soil	11·1	13	present	ciliates, amœbæ, monads
Heated to 40° for 3 hours	7·5	14·4	present	ciliates, amœbæ, monads
Heated to 56° for 3 hours	37·5	36·7	killed	all killed

Treatment with toluene leads to similar results :

	Bacteria after 30 days. Millions per gram	Ammonia and nitrate formed after 30 days	Detrimental factor	Protozoa found
Untreated Soil	8	24·5	present	cilliates, amœbæ, monads
Toluened soil	47·4	41·6	killed	all killed but certain monads

Quicklime also produces the same effect.

As the writers' methods of dealing with soil protozoa do not reproduce conditions in the soil, they abstain at this stage from laying too much stress on any relationship that comes out, but which may only be accidental, between their detrimental organisms and any of the ciliates, amœbæ and monads that their methods reveal. But it seems safe to draw two conclusions : (1) the detrimental organisms possess the properties of protozoa and not of bacteria ; (2) the presence or absence of the detrimental organisms is intimately associated with the presence or absence of a complex protozoan fauna.

The increase in bacterial numbers following after partial sterilization by volatile antiseptics is accompanied by an increase in the rate of ammonia production until a certain amount of ammonia and nitrate has accumulated.

when the rate falls. Thus two cases arise : (1) when only small amounts of ammonia and nitrate are present, there is a relationship between bacterial numbers and the rate of ammonia production ; (2) when large amounts of ammonia, or of ammonia and nitrate are present, there is no such relationship. The limit varies with the composition and condition of the soil.

Complications are introduced when the soil has been partially sterilized by heat, as the organic matter is decomposed and some of the bacterial varieties are exterminated. These effects become more and more pronounced as the temperature increases ; the maximum number of bacteria are found in soils which have been heated to 60° C, while this is the minimum temperature necessary to kill the detrimental organisms.

At this temperature, we have the same relation betweeen the two sets of organisms as obtains when the soil is treated with volatile antiseptics. Although bacterial numbers are at a minimum in soils heated to 100° C, the decomposition effected is at a maximum. With this exception, it is generally true that bacterial multiplication may go on without increasing the production of ammonia, but an increase in the rate of production of ammonia does not take place without bacterial multiplication.

The increase in bacterial numbers brought about by addition of bacterial from the untreated soil into partially sterilized soil leads to still further production of ammonia and nitrate, unless too large a quantity of these substances is already present. But the subsequent depression in bacterial numbers consequent on the development of the detrimental organisms is generally (though not always) without effect on the rate of decomposition, apparently because it does not set in until too late.—Russell and Hutchinson in the Journal of Agricultural Science.

THE EFFECT OF MANURING UPON MAIZE.

The results of some experiments carried out by Mr. W. A. Zuill, of Lower Southgate, in order to test the effect of manuring, especially potash manuring, upon the nature of the maize produced, are of sufficient interest to be recorded. One portion of the crop was left unmanured, a second treated with superphosphate at the rate of 4 cwt. per acre, and a third with 4 cwt. superphosphate and 1 cwt. sulphate of potash per acre.

Twelve stalks were taken from each plot as representing the average of the plot, and forwarded for examination. The weight of the whole plants

and of the cobs from each lot of twelve stalks was as follows:—

Table I. Showing Weights.

	Weight of Twelve stalks (with Cobs and leaves.)	Number of Cobs in Twelve Stalks.	Total Weight of Cobs in Twelve Stalks.		Average Weight of Cobs.
	lb.		lb.	oz.	oz.
No. 1—Unmanured ...	26	8	4	$8\frac{3}{4}$	9·1
No. 2—Superphosphate only.	32	10	6	2	9·8
No. 3—Superphosphate and sulphate of potash. ...	34	14	9	4	10·5

Assuming that the twelve stalks selected fairly represent the average of the plots, the results are fairly regular and striking. Manuring appears to have increased the weight of the individual plant (stalk, leaves, and cob), the number of cobs to the stalk, and the weight of the individual cobs. This increase is greatest in the sample manured with both superphosphate and potash.

The cobs from each sample of twelve stalks were then taken, and an average sample of the grain taken for analysis, with the result set out in the attached table. From this it will be seen that the grain from the manured plots is higher in albuminoids and carbohydrates than the other, and that the albuminoid ratio is narrower, providing a food of higher nutritive value.

Table II. Showing Analysis of Maize Kernels.

	1.	2.	3.
	Per cent.	Per cent.	Per cent.
Moisture	68·40	62·14	60·31
Albuminoids	3·77	4·66	5·01
Ether Extract	1·40	1·94	1·57
Fibre	1·13	0·88	0·86
Ash	0·72	0·78	0·85
Nitrogen free extract ...	24·58	29·60	31·40
	100·00	100·00	100·00
Nutritive value	31·5	38·6	39·9
Albuminoid ratio ...	1 to 7·4	1 to 7·3	1 to 7·0

Calculated to Dry Substance.

	1.	2.	3.
	Per cent.	Per cent.	Per cent.
Albuminoids	11·93	12·30	12·61
Ether Extract	4·44	5·13	3·96
Fibre	3·57	2·32	2·17
Ash	2·28	2·06	2·15
Nitrogen free extract ...	77·78	78·19	79·11
	100·00	100·00	100·00
Nutritive value	99·7	102·0	100·6
Albuminoid ratio ...	1 to 7·4	1 to 7·3	1 to 7·0

It would appear from the above figures that manuring, especially when carried out with a mixture of superphosphate and potash, increases the yield of maize, the number and weight of the individual cobs, and also the nutritive value of the grain.

It must, however, be said in warning that the above conclusions are only justified on the assumption that the samples taken truly represent the crop in each instance, and that it is an exceedingly difficult matter to take an average sample in the case of a crop like maize.

It must further be noted that the cobs were immature (the amount of water in mature grain being only about 12½ per cent.), consequently the figures only refer to the grain in this condition.—AGRIC. GAZETTE OF N.S.W.

SOME BACTERIOLOGICAL STUDIES OF OLD SOILS.

The writer had the opportunity of studying soil samples from the collection of DR. E. W. HILGARD which had been tightly stoppered for from 25 to 33 years; he was thus enabled to investigate the bacterial flora still present in them and the resistance of organisms to drying of the soil, which is a problem of much practical and scientific interest. Of the 9 samples examined, two were taken from alkali soil, two from adobe ridge (surface soil and subsoil respectively), one from adobe 10 or 20 inches in depth, one from black adobe 6 to 12 inches in depth, one from loam, one from foothill sandy soil 1 to 12 inches in depth, and one from rich loam.

The summary of the investigations was as follows:

1. Soils free from excessive alkali salts retained from 75,000 to 570,000 organisms per gram after thirty years drying under room conditions. Alkali soils contained under similar conditions 5,000 to 60,000 organisms per gram.

2. The ammonification flora is most resistant, being especially strong in the alkali soils.

3. Nitrification occurs feebly in two soils and is permanently destroyed in the other seven soils.

4. Though *Azotobacter* forms are entirely absent in all but the foothill sandy soil, the nitrogen fixation power of the soils is well maintained by other organisms.

5. There is no relation between numbers and physiological efficiency.

6. The persistency of these organisms under dry conditions and their renewed activity in the presence of sufficient moisture is agriculturally important.

7. The soil exhibits a protective function towards lower forms under adverse conditions.—THE PLANT WORLD.

THE VALUE OF SOIL ANALYSES TO THE FARMER.

By A. D. HALL.

After having dealt with the subject at length, the writer thus summarises the present position of soil analysis :—

1. Mechanical analysis enables us to classify soils and assign an unknown example to its type.

2. From the type, combined with knowledge of the situation and climate, we may predict its suitability or otherwise for particular crops.

3. Chemical analysis will tell us whether a soil is getting acid or needs liming to make it work properly and utilize the manure supplied to it.

4. From chemical analysis we can settle what class of manures ought to be used—whether sulphate of ammonia or nitrate of soda, superphosphate or basic slag.

5. Chemical analysis will often reveal particular deficiencies and the specific need for phosphates or potash, but to do this with any certainty, the composition and behaviour of soils of that type should be known from a previous soil survey.

The writer draws attention to the fact that abnormal soils have frequently to be dealt with, and in order to attack the problems presented by such soils it is necessary in the first place to accumulate information and data as to the nature and composition of known soils, and in the second place to increase our knowledge and perfect our methods of analysis. —MONTHLY BULLETIN.

AGRICULTURE ABROAD.

AGRICULTURE IN ANTIGUA.

The Report for 1911-12 on the Botanic Station and Experimental Plots in this Colony is to hand.

Cotton is one of the chief industries and is said to be regaining its former importance. The average return is given as between 140 and 150 lb. of lint per acre. Dr. Watt, the Commissioner of Agriculture, refers to the successful hybridization of different types along Mendelian lines, and of the great promise shown in the cross between Sea-Island cotton and the native variety (St. Eustatius.)

Sugar-cane is another important crop, the output for the year 1911 amounting to 11,078 tons sugar.

Among minor industries are mentioned lime, coconut and onion. At present there are between 500 and 600 acres under lime cultivation, showing that the industry is a fairly big one. On the other hand coconut cultivation is in its infancy, the area under the crop being between 175 and 225 acres nearly all situated in the south of the Island.

Onions occupied about 55 acres, and it is reported that there is room for expansion as most of the land is suitable for this crop. The export of onions represented by no less than £1,151.

Among possible new minor industries are mentioned Manicoba rubber, cacao, broom-corn and coffee; but so far little progress appears to have been made with these.

C. D.

PLANTATIONS IN GERMAN TROPICAL COLONIES.

The writer estimates the capital at present invested in plantations in the German Colonies at about £5,000,000. The areas brought under cultivation in the years 1907, 1908 and 1911 were, for the various crops, as follows:

Rubber Plants.

		1907	1911
		acres	acres
East Africa	...	12,479	81,450
Kamerun	...	5,142	17,745
New Guinea	...	4,376	5,812
Samoa	...	1,510	2,130
Togo	...	237	405
		23,744	107,542

Coconuts.

		1908	1911
New Guinea	...	45,367	62,430
East Africa	...	15,538	16,818
Samoa	...	9,425	11,587
Togo	...	1,433	1,433
		74,763	92,268

Sisal Hemp.

		1907	1911
East Africa	...	25,588	52,721
Togo	...	74	324
New Guinea	...	86	220
		25,748	53,265

Cotton.

		1908	1911
East Africa	...	15,182	35,356

Cacao.

		1907	1911
Kamerun	...	18,961	26,327
Samoa	...	3,754	5,392
New Guinea	...	555	1,021
Togo	...	230	371
East Africa	...	247	247
		23,747	33,358

SCHULTE IM HOPE, A. in DEUTSCHE KOLONIAL

SUDAN GRASS:
A NEW DROUGHT-RESISTANT FODDER PLANT.

Seed of the grass *Adropogon halepensis* was imported into the United States from the Sudan in 1909, and has been tried in Texas and other parts of the semi-arid zone. The grass yields well in specially dry seasons and the fodder is much appreciated by stock. Large quantities of seed are now being grown and the crop promises to be a valuable acquisition to dry land farmers:—C. V. PIPER in CIR: NO 125 OF THE U. S. DEPT. OF AGRIC.

GENERAL.

THE ACTION OF GRASS ON TREES.

The harmful influence of grass on fruit trees varies considerably with the nature of the soil and the method of treatment. Young trees planted in land already grassed or put down to grass immediately after planting suffer most, while if grass is merely allowed to establish itself slowly in an older plantation the effect seems to be reduced to a minimum. But the action is a perfectly general one, and with one single exception has been observed in all parts of England and in all classes of soil. The visible effect is not confined to stunted development, but is manifest too in the altered colour of bark, leaves and fruit.

Numerous possible causes of these changes have been investigated, foremost among which are lack of water and plant food owing to the competition of the grass. Trees under grass were watered by means of tubes so the soil in contact with their roots was moister than the adjacent tilled soil, observations taken one season showed that the moisture content in soil under grass was never reduced below the optimum point, yet in both cases the trees were obviously less healthy than similar trees in tilled soil. In other experiments carried out in pots the grass roots were prevented from coming in contact with the tree roots by a sheet of fine gauze placed about 4 inches below the surface, and plant food was supplied from below, yet even under these conditions the trees suffered from the grassing. Added to this, the general conclusions that trees in tilled soil do better in dry years than trees in grassed soil, in wet ones, also that soil under grass is usually richer than tilled soil, dispose of the water and food supply as possible causes. Feeding the sheep with green does not improve matters, and the effect of keeping poultry in grass orchards is now being investigated. Mechanical analyses of the soils failed to reveal any contributing cause, nor was the effect simulated when the soil was made alkaline. Lack of aeration would not appear to be of importance from a consideration of the iron drum experiments described in a previous article and of the fact that trees were grown in a soil artificially enriched with carbon dioxide without disturbance, and it is equally impossible to make differences in temperature between grassed and tilled soils account for the phenomenon. Finally, bearing in mind all the available evidence, the writer was led to the conclusion that the action must be due to some *toxic effect*, using the term in its wider sense to mean the presence of some poisonous substance in the soil, without defining its direct source; this hypothesis is certainly confirmed by the following experiment: trees were planted in pots the surface of which was covered by movable perforated trays on which the grass was grown. In spite of the complete separation of the grass from the tree roots, the growth was reduced by 25 per cent; when, however, the drainage from the grass was collected and left exposed to the air some time previously to being used on the tree, the effect was beneficial. These results indicate that the trees suffer by reason of something added to rather than removed from the soil, also that by oxidation the toxin is converted into plant food.

Now when a soil is heated, the amount of soluble organic matter it contains is increased, and at the same time the soil becomes toxic to germinating seed. Both these effects are considerable at 150° C., but diminish with the temperature; they are still recognisable at 60°C. and probably begin to operate at 30°C. A similar effect is obtained when a soil is treated with antiseptics, and the toxic substance decomposes gradually if the soil is aerated and moistened, but remains unaltered for several months if air is excluded from the soil; the rapidity with which the toxin is formed indicates that it is a direct and unstable product of chemical reaction. The soluble organic matter also decreases with time, but not as rapidly as the toxin, so that when the latter has completely disappeared some excess of the soluble organic matter is left over and accounts for the increased fertility of the treated soils. Tomato and tobacco plants grown in soil heated to 30°, 60°, 80°, 100°, 125°, and 150°C. respectively clearly showed the effect of these two opposing factors; after a preliminary check the plants grown in the soils heated to the lower temperatures recovered and were able to profit by the increased nitrogen supply, but when the soil had been heated beyond a certain point, the check was too prolonged and the plants never caught up lost time, so that it required a second crop to show the effect of the increased nitrogen supply. The results varied a little according to the sensitiveness of the plants, but on the whole the results justify the conclusion that the oxidisable substance which is toxic seeds is also taxic to plant growth. In order to extend the experiments to trees, the aeration of the soils was restricted by enclosing them in bottles, and under these conditions the toxic effect of those heated to 125° and 150°C became noticeable.

Coming back to the question of grassing, a somewhat analogous case is presented when soil is first uncovered by the removal of grass; it does not behave normally at once, but after exposure to the air becomes more favourable to plant growth than ungrassed soil, owing to the presence of a larger amount of nitrogenous and organic matter. The resemblance between the behaviour of grassed and heated soils is shown in yet another manner: owing to the presence of some oily or waxy substance heated soils are more difficult to wet than unheated soils, and this peculiarity is reproduced to a lesser degree in grassed soils. On the other hand grassed soils have never proved toxic to germinating seeds, so that the connection between the two cases is not established, though they undoubtedly have some points in common.

The writer is unable to accept Russell and Hutchinson's hypothesis of protozoa as the limiting factor in soil fertility, for on this hypothesis a maximum fertility should be obtained by heating soils to 50°C., at which temperature protozoa are killed with least injury to bacteria. He points out that his experiments do not confirm this view; but, he adds, on the other hand if the process is a purely chemical one resulting in the formation of a toxin it seems difficult to believe that the plant food liberated by heating a soil to 100°C. would be sufficient to account for the extra vigour of plants. He concludes by saying that "both explanations are probably correct but neither alone affords a full explanation of the facts."—S. PICKERING in SCIENCE PROGRESS.

THE SWEET POTATO.

After giving some information respecting the origin and history of the sweet potato and a description of its biological characters, the writer (Mr. G. E. Mattei) deals with the cultivation and utilization of this tuber. He calls to mind the uncertainty which still exists as to the origin of this species, which has so far never been found wild in any part of the globe and has therefore been attributed by several botanists to different genera.

Choisy called it *Batatas edulis*, thus changing the name of *Convolvulus Batatas* given to the plant by Linnæus and creating a new genus; now, the sweet potato is identified under the name of *Ipomœa Batatas* Poiret; it was considered by Asa Gray to be the cultivated form of *I. fastigiata*.

It has a number of populur names in America: "Ajes" in the West Indies, "Camotes" in Mexico, "Jatica" in Brazil, "Apichu" and "Skinet' in Peru. In Asia and Africa, the natives use names which cannot always be attributed with certainty to this plant alone; the most certain are "Dankali," "Kitaiti" and "Veezee," which are current in Central Africa.

The sweet potato requires an equable, sub-tropical climate; nevertheless it grows at high altitudes in temperate and nearly cold regions, such as Venetia in Italy, where it is extensively cultivated. The soil must be very thoroughly worked, but not too deep; it requires liberal supplies of potash and green manures, farmyard manure, cotton cake etc., should be given. It is multiplied by slips or "draws," the latter being the safer method. In both cases, the soil should be made into ridges 2 feet apart; on these the plants are placed in one line, at intervals of 1 foot.

In hot climates, the tubers attain their complete development three months after planting, while in Italy, even if they are placed in the ground at the most favourable date, the beginning of April, the crop cannot be dug until October. Under ordinary conditions and in temperate countries, the average yield is about 1 lb. per plant and 7 or 8 tons per acre.

The sweet potato is especially grown as an article of food and is much appreciated in hot countries; in Brazil, it is used for the preparation of an alcoholic beverage. The tubers contain from 15 to 30 per cent. of starch, which is easily extracted; this has lately been put on the market under the name of "Brazil Arrowroot." They also have 12 per cent. of sugar, but the latter is difficult to isolate owing to the presence of glucose. The very young stalks are eaten as a vegetable, the harder, stringy ones making good forage. The sweet potato is employed in the preparation of syrups, and its content of sugar only extracted with difficulty, together with its richness in starch, make it an excellent raw material for the alcohol industry.—Monthly Bulletin.

AN ANT REPELLENT.

Every resident in the Tropics is compelled to be interested in Ants. They are always a discomfort, often an intolerable nuisance, but it is only when they begin to swarm over our food that we cast about for some method of waging war on them. If the nest be known it can be destroyed by

pouring carbon bisulphide into it and immediately thereafter closing the openings with clay or covering them with a wet cloth.

It is of little use to kill the workers when they are out foraging, for only a very small percentage is abroad at any given time, and it requires a very small proportion of the available workers to provide the colony with food.

Some very interesting facts have been elicited by the Experts of the American Bureau of Entomology in the course of several years' investigations into the life-history and habits of the Argentine Ant (Iridomyrmex humilis Mayr). This ant, which was first noticed in New Orleans, Louisiana, some twenty years ago, has become a household pest of the first rank in large areas in Southern Louisiana and Mississippi, as well as in isolated areas in Alabama and California.

As the name implies it is a native of Argentina, and has been introduced into the States in the course of commerce. Not only is it a serious pest of the household, but, through its fondness for the excreta of scale insects, it has protected these insects against their natural enemies, with the result that they have multiplied to such an extent as to make orange-growing in infested parts of the Delta of the Mississippi unprofitable. Splendid orchards have been ruined in the course of a few years.

In addition to North and South America, this ant is known to occur in Madeira, Portugal and South Africa. In the last-mentioned place it is already a household pest and attends and protects scale insects just as in America.

In the course of their prolonged investigations the experts of the American Bureau found that the only repellent that would remain efficient for any length of time was dry corrosive sublimate. Ordinary cotton tape was soaked in corrosive sublimate solution, wrung out, and allowed to dry. This "ant tape" was then fastened round the legs of tables, along edges of shelves, etc., and it was found that it remained efficient for as many as eleven months, provided it was not allowed to get wet.

The corrosive sublimate tape is extremely poisonous and the same precautions must be taken in regard to its use as with any other poison † the same time, the experimenters state that they have never known of a case of poisoning resulting from its use.

Their method of preparing the tape is as follows:— The corrosive sublimate is heated in a *porcelain* vessel until the maximum amount is dissolved. This solution is allowed to cool, is then filtered, and ordinary cotton tape is soaked in it for several hours. The tape is then removed, pinned upon a wall to dry, when it is ready for use. It is very important, they state, that no iron, tin or steel come in contact with the solution or with the tape itself after being prepared.

It is hoped that the above method which has made life tolerable in the houses in the ant-infested districts of the Southern States, will prove equally effective against the ants of Ceylon, which, although not "Argentine Ants," have not a few of the characteristics of their Western relations.

A. R.

REASONS FOR DRAINING.

The chief object in draining wet land is not to remove the extra water. A wet soil is, of course, a colder soil, but in Victoria this would seldom be a sufficient reason for draining. The main object in draining land is to admit fresh air, and this can only be accomplished by getting the water out. Plant roots must breathe, and nitrification in soils needs fresh air, and in water-logged soils these results can only be attained by first removing the water- In an article contributed to the Deut, Landw Presse 39 (1912), the results of several years' observations on the effect of drainage are recorded. It is concluded that the most important factor concerned in the increased productivity of a soil from tile draining is the improvement in aeration. In order to increase the aerating effect, the tiles were sometimes connected with the upper air by placing vertical flues, but the results of this departure from ordinary practice are as yet inconclusive. The experiments are being continued. Probably the air drawn into the soil as the water soaks into drains in the usual way gives sufficient aeration in ordinary cases, and circumstances are conceivable which would even render the upright flues an impediment to aeration. The foul air or carbonic acid gas, produced in soils is itself heavier than air and subject to diffusion, will slowly find its way down the drains when these are not carrying water. This flow of gases will be faster the greater the fall in the pipes, and particularly when the subsoil is much colder than the upper air. But the most important action of drains is to promote aeration by first taking the water out.—Jour. of Agric., Victoria.

RAMIE.

Experiments in the cultivation of ramie have been carried on in the United States since 1860. Although none of them so far have led to a commercial industry, several kinds of ramie goods are appearing in increasing quantities in the American markets. Some mills are now engaged in the manufacture of these goods and others are being equipped for the work.

Ramie is cultivated commercially in China, in Japan, including Taiwan (Formosa), in Chosen (Korea), and, to a limited extent, in India and Africa.

Numerous experiments have demonstrated that it can be grown on suitable soils from Maryland to Texas ; also in California and Porto Rico.

A warm, moist climate is essential for the successful cultivation of ramie ; warm temperate climates rather than the tropics. Unless grown under irrigation or on moist bottom lands it requires at least 40 inches of well-distributed rainfall. It requires a rich, deep, moist soil, well drained yet not subject to drought. The following data were obtained by Prof. E. W. Hilgard at the California Agricultural Experiment Station.

Ramie is propagated by root cuttings or by seeds ; in the former case they grow more quickly and with more certainty. The seed beds must be covered with a cloth to keep the atmosphere warm and saturated with moisture. When 6 to 10 weeks old the seedlings may be transplanted to a

nursery, and two months later they may be set out in the open field at 20 to 30 inches apart in rows 3 to 4 feet apart. The land between the rows must be cultivated. If irrigated, the furrow system must be used to avoid covering the young plants with water.

Soil ingredients (in pounds) withdrawn from 1 acre by a crop of ramie.

Soil ingredients.	Leaves 8,500 lb.	Stalks 14,500 lb.	Bark 5,500 lb.	Whole plant 28,500 lb.
Potash	68·13	155·99	27·86	251·98
Soda	8·90	33·63	7·52	50·14
Lime	566·91	71·77	19·14	657·82
Magnesia	114·58	43·68	10·01	168·27
Manganese oxide ...	1·92	1·45	0·20	3·57
Ferric oxide and alumina ...	38·56	12·16	0·71	51·43
Phosphoric acid ...	77·13	67·71	10·86	155·70
Sulphuric acid ...	30·86	14·53	3·17	48·56
Silica	692·71	7·06	4·48	704·25
Chlorine	41·56	2·50	7·79	51·85
Total ash constituents ...	1641·35	410.85	91·74	2133·57
Nitrogen	206·10	105·85	57·75	369·70

Yield of ramie stalks and fibre in pounds per acre.

Year.	Green Stalks.	Air-dry Stalks	Dry Fibre.
First	6,000	1,500	300
Second	12,000	3,000	600
Third	18,400	4,600	900
Fourth	26,400	6,600	1,300

The first stalks of ramie are usually much branched and of no value. It is best to cut off the first shoots when they are 10 to 30 inches high to induce a thicker and more uniform growth of shoots. Afterwards one to four, usually two, crops are cut each year. In Asia each stalk is cut as it matures, leaving the younger stalks to grow. If the ramie is to be

decorticated green it must be stripped immediately after being cut; if the operation is to be carried out when dry the ramie should be cured in the swath or gavel and care must be exercised to avoid heating or moulding. The strips of bark with the fibre are called "ramie ribbons." The hand-cleaned fibre free from the bark and pulp is called "China grass." The fibre in order to be spun is degummed by chemical processes and then combed to remove the short fibres or "noils" from the long ones or "tops." Both tops and noils are spun.

The yield of stalks usually increases up to the fourth year. The following data are based on numerous experiments made in France:—

The production of raw fibre from two annual cuttings in experimental plantings ranges from 500 to 2,800 lb. with an average (eight different authorities) of 1,293 lb. The yield of dry fibre is 3 to 5 per cent. of the weight of the green stalks, or 15 to 20 per cent. of the air-dry stalks. In Formosa, where three or four crops are harvested each year over about 5,000 acres, the average annual yield is about 700 lb. per acre. In Hunan, and Hupeh, China, the annual yield is 400 to 600 lb. of China grass per acre from three crops.

The ramie fibre, cleaned by hand in China, can be delivered in San Francisco or New York at 6 to 10 cents (about 3*d*. to 5*d*.) per pound. It is roughly estimated that the importations of China grass into the United States now amount to nearly 1,000,000 lb. annually, besides considerable quantities of yarns and some degummed filasse from Europe. Hongkong is the principal shipping port for the fibre.

The cultivation of ramie is limited to the countries having cheap, skilled hand labour; this is chiefly due to the lack of satisfactory mechanical methods for separating the fibre. Recently some European firms have put on the market some machines for this purpose, and some very promising work was done in trials with a machine built in the States to decorticate ramie fibre from the dry stalks. Fibre decorticated from green stalks is desired for most degumming processes, and machines are now being perfected for this work.

The outlook for the ramie industry in the United States appears promising. The question, however, remains whether this fibre can be produced at a cost permitting it to compete with the Chinese fibre.—Monthly Bulletin.

WATTLE BARK.

According to the Report of the Trades Commissioner for South Africa (1911, p. 32), the continued increase in the output of wattle bark must lead to a fall in price. Attention has already been called to this subject in the Imperial Institute Bulletin (1911, p. 116). The export statistics for 1911 show that out of the 50,000 tons of bark exported, Germany took about 30,000 tons, and although a large quantity was shipped to the United Kingdom, only a small percentage was consumed in this country. It is suggested that a larger market could be found in the United Kingdom for this material in the form of extract. Further enquiries showed that wattle extract could be profitably manufactured in South Africa, and it is advised that the extract take the form of "crystals" containing not less than 60 per cent. of tannin. The estimated cost of a complete plant to treat 75 tons of bark per week is given as £10,000 f.a.s. Glasgow, or to treat double the quantity as £15,000.—Imp. Inst. Bulletin.

THE ALGAROBA BEAN.

(*See Frontispiece*)

According to a Bulletin by MR. WILCOX of the Hawaii Agricultural Experiment Station this is the most valuable tree so far introduced into that territory. It is supposed to have been first planted about 1828 by the Catholic Missionaries at Honolulu.

The genus *Prosopis*, of which there are 18 or more species, is native to tropical and semi-tropical America, occurring from Texas to Chili and in the West Indies.

The Algaroba bean thrives in dry localities at low altitudes up to 2,000 feet.

The flower is an important source of honey, but its chief value is as a forage crop, the pods being of high feeding value for all live stock including chickens. In its native habitat, where extensive forests of the tree occur, the wood is used as fuel and for making charcoal, while the bark yields tannin and gum. As a shade and ornamental tree it is much appreciated, as the foliage is delicate and graceful. Piles of Algaroba wood are said to withstand the attack of Toredo and the pods are considered a likely source of alcohol and vinegar, owing to the large percentage of sugar they contain. The whole pod has the following composition :—water 15·26, protein 8·89, fat 58, nitrogen free extract 47·27 and crude fibre 24·75, ash 3·25.

The Agricultural Society has from time to time imported seeds of the tree for distribution among its members, and a stock of nursery plants is kept at the Government Stock Garden, Colombo, where there is a tree over 5 years old which has not yet borne fruit, the climate probably being too damp for it.

C. D.

TEFF (ERAGROSTIS ABYSSINICA).

MR. BURTH DAVY, who introduced the cultivation of teff as a forage grass into the Transvaal in 1903, says the *Monthly Bulletin*, gives an account of its history in that country, and shows how slowly the crop came into favour in spite of favourable reports on trials made in Natal as far back as 1887. It has now proved itself a complete success and is fast becoming a staple hay crop throughout civilized Africa, its qualities being: palatability, high nutritive value, heavy yield, rapid growth, drought resistance, and ability to smother weeds. The experience of the Transvaal might well be repeated in India and Australia where preliminary trials proved satisfactory, but where the subsequent popularization has not yet occurred.

HOW TO FIGHT DROUGHT.

During a hot, dry period when the sun is at its highest altitude and drying winds are prevalent there are many plants which suffer from the consequent drought, and any means by which this risk of damage may be reduced, especially at a time when labour is in the greatest demand, are welcome, says *The Gardeners' Chronicle*. Naturally, the first impulse of the conscientious gardener is to supply the water which is lacking, but in many cases it would be better to take other means. When water is given to the ground great care should always be used to supply it in a form as nearly resembling the falling of rain as possible; by this means it is broken up into numerous small particles which have sufficient time to become warmed before reaching the roots. Moreover, when water is given in this way it has time to percolate gradually into the soil without causing a hard crust to form on the surface, and even when the greatest care is exercised it is advisable to move the surface soil as soon as it is sufficiently dry, so that the percolation tubes caused by the water passing into the ground are broken at the surface. This effectually stops evaporation, and consequently less water is needed to keep the soil in a moist condition.

On heavy soils it is seldom necessary to give any water to growing plants for the simple reason that the subsoil contains enough surplus water to carry them over any period of drought such as we experience in the United Kingdom: that is, providing the proper measures are taken to conserve the water in the sub-soil. In many hot, dry countries this conservation of water is carried on under the name of "dry farming" to an extent which is astonishing, and gives better results than irrigation, and this with the use of much less labour. The invention of many new tools for carrying out this form of culture has no doubt helped to spread this practice, but it might be adopted to a far greater extent than it is at present.

The first movement of the soil should be made with a toothed "cultivator," which makes the work far easier and more speedy of accomplishment than with a "Dutch" hoe. Care should be given, not so much to the cutting of weeds, as to the thorough breaking up of the surface; then a hoe over, and the ground will continue in a soft, friable state, easily and speedily worked, and it will act as a blanket, conserving the moisture in the soil and yet allow the air to penetrate with beneficial results.

If soil is treated in the way outlined above, the root action will be perfect if everything else is right, and all the water that will be required is a light spraying after the sun is off the plants.

As much, or even more, benefit can be derived from the considered use of a spraying machine than from root watering; there never was a time in

the history of horticulture when the engineering part of spraying was so perfect, and so easily manipulated, and yet in many of our large establishments a spraying machine is seldom used for the simple spraying of water on outside subjects. We go on spraying plants which are in greenhouses, never realising the great benefit which would follow from the same operation outside, added to which is the economy both in water—which is a great consideration when it has to be carried a distance—and labour. The time when plants make the most growth is "after the turn of the day." At this time the nights become longer, and plants are subject to heavy dews, and hence are able to obtain all the water they require. Now if this happy state can be realised earlier in the year by artificial spraying, the crop will give in many cases a double yield, and fully repay the little extra work. It is wonderful to watch how quickly a plant recovers from the utter exhaustion of a sunny day, when it receives a gentle fine spray under the foliage. It has the same effect that a bath has on a tired man, and it should be practised, especially on heavy land, to the exclusion, or nearly so, of root watering.

Mulching of garden crops with short manure is another means by which water can be conserved in the soil, but possibly there are more reasons against this practice than appear on the surface, especially for plants growing in the open ground. It is often assumed that plants gain a considerable amount of nourishment from the manure used, but this can only be true where there is plenty of time for the plant food to become available, and even then rain or artificial watering is needed to bring the food in contact with the roots. The filthy practice of using manure for the bedding of strawberries requires no comment.

SHADING.

Shading is a means of helping plants to give the best results, which deserves more attention in these days of cheap material suitable for the purpose.

The writer had the pleasure a short time ago of perusing a pamphlet containing a description of an invention by one of his predecessors. This invention, for which a gold medal was awarded by the Caledonian (or Scottish) Horticultural Society, some eighty years ago, was roughly a shallow box fastened round trees on walls, which had an arrangement of tiffany curtains which could be drawn in front of the trees at will, for several purposes, among which was the retarding of the ripening process of Peaches. The price of tiffany was given as 5*d*. per yard. It can be purchased now for less than half that price, and when it is fastened to roughly-made frames there are a variety of uses to which it can be put; shading is one of these. There are many tender subjects which will benefit by their use, and for Sweet Peas, which burn with the sun, they are indispensable.

SMALL HOLDINGS.

The July issue of the JOURNAL OF THE BOARD OF AGRICULTURE contains an account on Small Holdings in Sweden from the Report of the Departmental Committee on Buildings for Small Holdings of which the following is an extract :—

INSTRUCTION AND ASSISTANCE FOR SMALL-HOLDERS.

It is usually recognised in Sweden that the placing of men on the land is but the first step, and that it is of great importance that they should receive instruction and guidance in the subsequent management of their holdings. The measures taken by the State to supply this need, of course, are not limited to those occupiers who are assisted to obtain land by means of State funds, but are part of a scheme for encouraging improved methods in the cultivation of small holdings generally. A very important part in the administration of the laws affecting agriculture is played by the agricultural societies ; most of these have been in existence for about a century, and one is generally to be found in each county. Since 1902 a number of laws have been enacted with the view of improving the cultivation of small holdings ; some of the more important of the measures adopted are as follows :—

AWARD OF PRIZES TO SMALL-HOLDERS.

Each agricultural society divides its district into two or three "Rewards" districts, and awards prizes every few years for the best kept and most productive small holding. Tenants of holdings not exceeding 30 acres are eligible for these prizes.

TOURS OF INSTRUCTION FOR SMALL-HOLDERS.

Men and women occupying holdings not exceeding 100 acres can take part in these tours, which are found to be conducive to improvement in the cultivation of small farms. Travelling expenses are paid by the State, and other expenses by the agricultural societies, the itinerants sometimes contributing a small sum themselves.

INSTRUCTION AND PRACTICAL TUITION.

The people's high schools,* which have been in existence for nearly fifty years, provide educational facilities for farmers' children giving agricultural instruction of a general character ; and closely connected with them are the agricultural schools proper. Purely agricultural tuition for small farmers is provided by means of local courses lasting six or fourteen days. A new and similar type of agricultural school is now being established, which is intended primarily for the sons of small farmers, those who have only passed through the elementary schools being eligible as pupils.

There are five State consulting advisers and inspectors in agriculture, one of whom devotes his whole time to small holdings. Their duty is to supervise and instruct the numerous provincial agricultural experts (agronomes), who advise small holders throughout the country ; to advise generally as to any measures that will improve and develop agriculture, and to promote the creation of associations of all kinds.

* "Folkshogskola"—a special type of school characteristic of Sweden, Norway and Denmark.

In some districts trial has been made of a system of itinerant foremen, who are given much smaller districts (comprising only one or two parishes) than those assigned to the local agricultural advisers. These foremen advise the small farmers in regard to the practical working of their farms; they are the servants of the provincial agricultural societies, but the State gives a grant in aid, and provides courses of instruction for their training.

THE IMPROVEMENT OF FARMERS' HOMES.

Courses of lessons in cookery and domestic economy are provided, and tours of instruction for women also constitute a feature of this work. Advisers in household management have been appointed in some districts, and it seems probable that this movement will be considerably developed. Two country homesteads have been fitted up to serve as demonstration centres for the whole range of domestic work.

ENCOURAGEMENT OF ASSOCIATIONS.

Much importance is attached to the organisation of agricultural associations of all types, and especially to those intended for the benefit of small farmers, such as milk-control, bull, book-keeping societies, etc. The State aids in this work by providing instruction as well as by giving considerable financial assistance.

Sales of Produce in British and Continental Markets.

Fibres, Cotton, Grain, Oil Seeds, Hydes and Skins, Timber, Rubber, Drugs, Wool, Ores, Mica, Gums, Tea, Cocoa, Coffee, Copra, Sugar, etc., are being regularly dealt in; Keymer, Son & Co., being selling Agents for Estates, Mills and Exporters.

Samples Valued.

Best Ports for Shipments Indicated.

THE MANAGEMENT OF

ESTATES UNDERTAKEN.

Capital found for the development or purchase of valuable properties.

KEYMER, SON & Co.,

Whitefriars.
LONDON, E.C.
(Same address since 1844.)

Cables:
KEYMEY, LONDON.

PRICKLY PEAR.

Mr. J. Rasmussen, who recently arrived in Australia from America, apparently sees no difficulty in the way of getting rid of the prickly pear pest. He proposes to cut it by machinery, and utilise it for various purposes. He stated that in Honolulu, Arizona and Mexico the prickly pear is abundant and is used after treatment for the nourishment of man and beast, and also in the manufacture of liqueurs. He saw enough to convince him that it was an easy matter to clear it off the land. The cactus itself could be used in the manufacture of pulp for paper, leather boards and other purposes. He had visited the Burbank experimental farms, and had seen the spineless cactus, and advocated its introduction into the dry regions of Australia. From root to tip the cactus was practically all food and drink, and was greatly relished by all herbivorous animals, as well as poultry. In some parts the cattle and horses never drank water at all, getting all they needed from the cactus, which contained about 80 per cent. of fluid. Animals fed entirely on it improved in condition in quite a wonderful manner. There were vast possibilities for the unused lands in the interior, where there was not sufficient grass or water to maintain stock. The cactus would supply both needs. The ordinary prickly pear was not to be despised as a tasty preserve, and he claimed that more sugar could be extracted from it than from sugarcane, and that the product was of equally good quality.

AS A STOCK FOOD.

Mr. E. A. Smith, Inspector of Stock at Mungindi, writes:—In the article "Vegetable Pathology," by Messrs. Brunnich and Smith, I notice that it is said that prickly-pear leaves could be utilised as a stock food. I may tell you that when I was Crown Lands Ranger at Taroom, I was inspecting a selection, where I saw a number of pigs running loose. On reaching the selector's (a German) house, I saw in the yard a large boiler, and inquired what was in it. The selector informed me that he boiled the pear for the pigs, and they did well on it. I found out that he fattened by this means a large number, and then drove them down to Miles Railway Station. I think pigs would take to this diet better than cows, though it is well known that cattle are very fond of the green shoots and devour them greedily. I noticed, in a fat-bullock paddock on a station near Taroom, that the leaves of the scattered pear were all bitten half off. There is no doubt that in time of drought cattle will live and fatten on the pear—that is, not on the long spiked variety, but the other. If you want any further information on the subject, I should be gald to give it to you, as I was nearly two years among the pear districts, inspecting selections and so on.—Queensland Agricultural Journal.

DESTROYING STUMPS WITH CHEMICALS.

Persons unaccustomed to handling certain chemicals are warned not to follow the directions given in this journal for destroying stumps by the use of a mixture of nitric and sulphuric acid. One of these requires to be added very slowly to the other. If they are rapidly mixed there is danger of injury to the operator. In the same way, when one acid is poured into the hole made in a stump, and the other is added quickly and the hole at once plugged the violent reaction of the acids may blow out the plug, part of the acid may follow, and there is danger that the operator's hands may be severely burnt, or even that he may be struck in the face by the plug, or have his eyesight injured by the acid.—QUEENSLAND AGRICULTURAL JOURNAL.

THE WAX PALM

A New and Promising Cultivation of great importance to all Tropical Planters.

The Wax Palm (Copernicia cerifera) produces the valuable Carnauba Wax; this tree accommodates itself easily to climate and soil and can be interplanted with cotton, food or fodder plants, green manure, etc. To Coffee, Cocoa, Rubber, etc., it offers shade, but at the same time it allows sufficient light and air to pass to the trees below. Therefore the Wax Palm is not only a very useful but also a profitable acquisition.

For trials we supply on receipt of 7 shillings and 6*d*., 75 seeds as sample of no value under registration, postage paid; on receipt of £4, we forward 10 lb. seeds by parcel post, postage paid to all countries.

Detailed instructions for cultivation with every order.—

GEVEKOHT & WEDEKIND, Hamburg 1.

Proposed College of Tropical Agriculture.

Copies of the Detailed Plans of the proposed College of Tropical Agriculture at Peradeniya can be had on application at the Government Stock Garden, Thurstan Road, Colombo.

PALMYRAH LEAVES.

In the North of Ceylon the leaves of the palmyrah palm (*Borassus flabellifer*) are used for a variety of purposes, for mat and basket making, thatching roofs of houses, constructing fences which are durable as well as ornamental, feeding cattle and goats, and, after some preparation as a substitute for paper and for making very handsome fans. This paper material is known as ola, and is also prepared from the leaves of the Talipot palm (*Corypha umbraculifera*). They are found bound up in the form of books of great age, containing historical records inscribed by means of a stylus.

Leaves for olas and fans are cut from young trees of 4 or 5 years old. These are spread flat on the ground, covered with sand with weights placed over them and left for 4 or 5 days so that they may dry without shrinkage. After this the lower portion of the leaves, that is the petiole end, is cut away and the upper part taken for use.

Recently the Secretary of the Ceylon Agricultural Society conceived the idea of getting cards cut from palmyrah leaves, with the object of using them as visiting cards. These were found to take printing well, and are of the colour and appearance of ivory. For this purpose the tender leaves were taken, that is the unexpanded leaves which are almost white in colour, and spread out to dry for a couple of days in the way already described. Afterwards they are split up into the naturally divided sections by the removal of the veins and then cut to the required size of the cards. On samples being sent to the Imperial Institute, the Director reported as follows:—

> "The specimens are interesting and if the material does not become discoloured on continual exposure to light it could doubtless be used locally for museum labels, etc. Attempts were made some years ago to find a market for palmyrah leaves in the United Kingdom, but without success. The leaves might be used for paper-making, but their bulky nature and the consequent high cost of transport would render their importation unremunerative. It is however possible that they could be used for paper-making in Ceylon, or be converted into "halfstuff" and exported in the latter form. In this connection reference should be made to the articles on papermaking materials in the *Bulletin of the Imperial Institute*, Vol X (1912), p. 372, and Vol. X1 (1913), p. 136.

COMMITTEE OF AGRICULTURAL EXPERIMENTS.

The following is an abstract of the Minutes of a meeting of the Committee of Agricultural Experiments held in the library of the Royal Botanic Gardens on Thursday the 10th July, at 4 p.m., the Director of Agriculture in the chair.

There were 37 members and visitors present including the Hon'ble the Acting Colonial Secretary.

MR. DOOLAN, Representative of Nobel's Explosive Company, Hamburg, was present and answered many questions put to him by the Committee regarding the various uses of dynamite. He estimated the cost of blasting with Nobel's Hamburg Dynamite No. 1 as follows:—one case containing 200 cartridges $\frac{7}{8}$ of an inch in diameter cost Rs. 24·00 or cents 12 per cartridge; detonators Rs. 19·50 per thousand or two cents each; fuze about 1 cent per foot; there being 24 feet to a coil.

Using at the most for a two-feet hole:—

Half a cartridge	... ...	6 cents.
One detonator	... ...	2 ,,
2 feet of fuze at 1 cent per foot	...	2 ,,
		10 cents per hole.

Two coolies can put down 25 holes per hour or 175 holes in a day of 7 hours. Labour cost for each cooly 35 cents—70 cents for two coolies; add two other coolies, experts in making primers, charging holes and firing same at 50 cents each per day, Re. 1·00 bringing the total cost of labour to Rs. 1·70 per day, equal to 1 cent per hole (175 holes) making the total cost of labour 1 cent per hole. The total cost of dynamite, detonators and fuze and labour is thus 11 cents per hole.

COCONUT TRIAL GROUND, CHILAW.

The Chairman informed the meeting that a Coconut Trial Ground was opened at Chilaw on July 1st and that experiments were to begin on the 1st October. The next meeting will be held on September, the 30th, the day preceding the experiments at 10-45 a.m. at Mr. N. J. Martin's residence.

RIO RUBBER EXHIBITION.

The Chairman read a letter which the Planters' Association received from Dr. Willis regarding the Rubber Exhibition to be held at Rio de Janeiro.

Mr. Layard undertook to reply that it was too late now for Ceylon to participate in the Exhibition.

LONDON AND JAVA EXHIBITIONS.

The Chairman said that Mr. van Laer who was on a visit was requested to inform Ceylon that Java was having a Rubber Exhibition in September, 1914.

The following resolution was drawn up and it was decided to await the decision of the Planters' Association before forwarding the same to Government:—

"The Chairman be requested to represent to the Government the unanimous feeling of the Committee that Ceylon should exhibit at the London Exhibition in 1914 on the same lines as those of 1911."

LADDER TAPPING.

MR. WILKINS inquired the effect of ladder tapping, the bark below being finished and not sufficiently renewed.

MR. PETCH replied that, in his opinion if the lower part of the stem had been allowed four years for renewal, and ladder tapping was practised merely because the lower part was untappable owing to nodules, there was no *physiological* objection to it; but if the tree was tapped above six feet before renewal was complete below that, the practice was to be deprecated, because the diminished amount of food which could pass the tapping cuts would be insufficient to provide for adequate renewal over so large an area.

STERILISING OF MANURES.

MR. PETCH stated that 12 samples of manures received from Manure Merchants had been tested for weeds with negative results. Basic Slag and Sulphate of Potash had also been added to these, but no weeds had appeared. Five samples from estates had undergone a preliminary test, and were now being tested more fully : up to the present no weed had appeared.

Samples of weeds had been received from three estates, and others were expected.

It was pointed out that these negative results did not correspond with the experience of estates. The Chairman replied that the trials had been carefully conducted in the only way to test the question whether the samples of manures contained weed seeds and that there was no escaping from the results.

PROGRESS REPORT:
EXPERIMENT STATION, PERADENIYA.

FROM 8TH MAY TO 10TH JULY, 1913.

TEA. 1. The yield for the last two months of May and June has been 12,316 lb. picking to fish leaf for three rounds. The price obtained has only been 6 cents per lb. Plots 141, 142, 143, 144, 145, 151 and 152 have all been pruned, from middle of May. All have been manured up alternate lines starting from the second row of each plot, with 200 lb. Basic slag and 60 lb. of Sulphate of Potash per acre and mulched with prunings, except plot 143 in which the prunings were buried in holes between each 4 bushes.

Dadaps have all been pruned, total weight of green material 1,794 lb. from one acre.

Albizzias have been supplied.

The remaining portion of tea will be pruned in July.

2. The young plants imported from India, in the nursery, that have suffered so from grey blight, have been transplanted into fresh beds, carefully prepared and well manured. All the drains through the tea have been thoroughly cleaned out.

CACAO. 3. A small round of pickings has been done, yielding 127 lb. of wet cacao,

All the plots have had the excessive shade removed by lopping off the dadap branches, but these, not having been pruned for three years, the branches had become very big and heavy, doing considerable damage to the cacao trees underneath.

4. A round of canker and sucker removing has been begun and the canker does not seem so bad as last time. Many useless trees, shrunken and shrivelled by much bark-removal, have been cut down, as they were merely usurping plant-food and air from neighbouring strong plants.

5. Young plants of Forestero cacao were planted out as supplies, in plots 63—67 at the beginning of June and, by well mulching and shading, they have survived the ensuing 3 weeks' drought very well. Not having enough plants the rest of the plots was sown with seed at stake. These plots have been carefully pruned to get the trees into good bearing and shape, and pests of cacao borer and scale have been got rid of by spraying with a mixture of kerosine oil and soft-soap, and by a sharp wire inserted in the borer's hole.

6. Not having enough Nicaraguan cacao plants to plant up the new two-acre plot which has been cleared, this will be planted with young dadaps, so as shade will be provided for next year's planting; meanwhile a crop of green grams will be sown to enrich the soil.

CASTOR OIL. 7. A plot of castor oil seeds of various varieties and from various provinces has been sown and has germinated fairly well.

MAIZE. 8. A plot of Hickory King maize has been sown and has germinated very well, in spite of the fact that many of the seeds were attacked by weevil; also a plot of native maize.

COFFEE. 9. The Hybrid (*Coffea cannephora*) coffee shows signs of scale or green bug (*Coccus viridis*) showing this variety is by no means immune, but it is noticeable that much of it has been attacked and killed by the fungus, *Cephalosporium lecanii*. The robusta coffee also shows the scale and fungus.

COCONUTS. 10. The ten-acre plot of young coconuts has been thoroughly ploughed and disc-harrowed and got into good, clean order, and has been sown by natives in various catch-crops, on the understanding that the land is kept perfectly clean and round the trees kept clear for a distance of six feet. Half the crop will be ours and half the natives'.

All the manured plots have been cleared and re-manured.

HEDYCHIUM. 11. Six bundles of *Hedychium coronarium* were received from Hakgala Gardens and these having been deleafed were lightly passed through the rubber creping rollers, which split the stalks without injuring the fibre. The stalks were then thoroughly sun-dried and despatched to Kew for report as to its paper-making value.

Roots of *H. coronarium* and *H. flavescens* were planted, half in a not-too-wet paddy field, and half in ordinary soil. That in the latter soil seems to be doing the best up to the present.

LUCERNE. 12. Some seed of acclimatised Indian lucerne has been sown and has come up well in spite of a dry spell occurring soon after it germinated.

GREEN AND BLACK GRAMS. 13. These have been sown in two plots to mark their enriching effect on the soil.

FRUIT PLOTS. 14. These have been interplanted with various European and native vegetables to act as a catch-crop to pay for the fruit-tree cultivation, and as an example of how vegetable and fruit farmings should be properly and profitably carried on.

RUBBER. 15. 50 lb. of fine crepe and 50 lb. of Wickham's smoked blocks, both from the same trees, have been despatched to the Imperial Institute for analysis and report. The Smoker has not been working for the last month as there was so very little available latex and the Smoker to be erected at Heneratgoda should turn out all that will be required for experimental work.

The two new clearings, the Top and Hill-side, of about 9 and 8 acres each, have been felled and cleared and the drains and roads nearly completed. Work was much delayed owing to lack of labour. The top clearing was planted on July 1st, at which date the delayed rains really set in, in holes blasted by dynamite, costing including cost of cartridges, charging, boring holes, firing, opening and filling up holes with surface soil, 25 cents per hole. Only half cartridges could be used on the rocky hill-side as the rock resistance caused dangerous, upward explosions.

Two plots on the level were planted according to the Director's new plans 40 ft. × 10 ft. × 12 ft. in clumps of four and 40 ft. × 15 ft. × 15 ft. avenues. The rest was planted 20 in. × 20 in. The whole of the "Hill-side" plot was planted also on July 1st 20 ft. × 20 ft. in blasted holes. *Cephrosia candida* has been interplanted 3 feet apart, to act as a green manure, to stop surface wash, and to keep down the weeds.

The plots 14 and 15 have been supplied with young plants from No. 2 tree, Heneratgoda, making these plots of one strain, but they suffered from the ensuing drought in spite of being mulched with indigo and being watered. The plots were well disc-harrowed and sown with indigo seed as a green manure and this is germinating slowly, as is its habit. A two-acre plot next the old rubber, has been cleared of old cacao, ploughed and planted in blasted holes with rubber in avenues 40 ft. × 15 ft. × 15 ft. and interplanted with green grams sown as green manure.

Two isolated plots of an acre each, one where the old sisal plants have been cleared away, and one at the top end of the young cacao plots (Nos. 63—67) have been planted 33 ft. × 33 ft. with plants of the black-seeded, good-latex yielder Hevea tree at Heneratgoda and interplanted with *Tephrosia candida*.

The old banana plot has been planted with plants from a large-seeded tree at Heneratgoda 33 ft. × 33 ft. and all the banana trash buried in trenches dug round the trees.

16. The *Manihot dichotoma* has been tapped since June 1st, both by the stabbing and herring-bone system, the latter giving a much higher yield. Many of the trees planted 6 ft. × 6 ft. have been blown down and show root-disease.

17. The Ceara rubber, now being [illegible] by stabbing and herring-bone has been started early in July.

18. With regard to the rubber tapping experiments, these are going on satisfactorily. It is noticed that in row 86 A and C of the 48 trees—which are being tapped with the Northway serrated knife, cuts $\frac{3}{4}$ inch apart and full herring bone, from August 1912, and which were not previously tapped and 87 were quite free of nodules, are now badly affected with 19 nodules. But row A, 24 trees, tapped in the same way, only cuts $\frac{1}{2}$ inch apart, half herring bone, from January 1912, shows no nodules.

The rubber trees interplanted in 1908 through the tea plots 151—2, planted 24 ft. × 12 ft. beginning to over-crowd each other, have been considerably thinned out and will require still further thinning as those most crowded begin to show it. Plot 153 and 154 planted 20 ft. × 20 ft. show no signs of over-crowding.

BANANAS. 19. Two plots of an acre each have been prepared of these and planted in blasted holes. The "River-bottom" plot in Koli-kuttu, Suwandel, and Hondarawalu manured with Castor Cake 140 lb., fish 167, Precipitated Phosphate 112, Sulphate of Ammonia 150, Muriate of Potash 100. The suckers were cut off short and planted on their side with an "eye" uppermost, in the proper West Indian manner of planting. The second plot near the Camphor has been planted with Hondarawalu, Alu-kehel, Red Plantain (Rathambala), Table-plantain (Puwalu), Anawalu and manured with Basic slag 300 lb. Nitrolim 200, Muriate of Potash 100, Lime 100.

Part of these have been planted according to the Sinhalese manner, i.e., standing up, so as the difference in growth, size, quality, and flavour of the fruit may be gauged. One row was planted in ordinary hand-dug holes.

OIL GRASS. 20. The plots of various oil grasses have been supplied up and are responding very well to mulching with their own refuse after distilling. But as the price of Citronella oil is only Rs. 1·25 per bottle, it does not pay for the cost of cutting and distilling on such a small scale. Distilling will in consequence be discontinued, but a record will be kept of the number and weight of cuts.

SHOW PLOTS. 21. These have all been filled up with various green manures and other crops.

LABOUR. 22. New cooly lines have been finished, but owing to the impossibility of obtaining new advances from the Government till the end of the financial year, no new Tamil coolies could be got till the end of July. This shortage of labour was partly met with by Sinhalese labour at 45 to 50 cents per day, and even then very scarce.

VISITORS. 23. 57 visitors have been shown round the Station during May and June.

INCREASING THE DURABILITY OF TIMBER.*

The growing scarcity of many kinds of timber and the increased cost of timber generally have necessitated the use of some preservative to protect it from decay, especially in view of the fact that something like 80 to 85 per cent. of the timber used is lost by decay, the remainder being sacrificed to fire, insects and mechanical destruction. Creosote oil has been found to be

* This memorandum was drawn up by the Departmental Committee of the Board on Duration of Buildings and published in the Report of the Departmental Committee of the Board on Buildings for Small Holdings.

a most useful preservative of timber, and even when the process of creosoting was effected by simple absorption, its advantages were clearly apparent; but since the introduction of the method of creosoting timber under pressure more than 60 years ago, the durability of wood, when properly treated with creosote, has been more conclusively demonstrated. The employment of creosoted timber, moreover, by increasing the durability of wooden structures, has tended to diminish the cost of repairs. In connection with the use of creosoted timber for buildings and fencing for small holdings, the question of the cost of creosoted, as compared with that of untreated timber, as well as the relative value of the process in its application to timber of various kinds, is very important.

COST OF CREOSOTING UNDER PRESSURE.

Dealing first with the question of cost: MESSRS ENGLITH BROS., of Wisbech, state that the process of creosoting adds from 15 per cent. to 25 per cent. to the cost of the timber, but as it more than trebles the durability of exposed woodwork, the economy of its use is evident. Upon inquiry, they supplemented this statement with the information that the cost of properly creosoting under pressure by Bethell's process adds from 4*d*. to 6*d*. per cubic foot to the cost of wood, according to the quantity of oil stipulated. In this connection, they recommend from 8 to 10 lb. of oil per cubic foot of wood, the cost of the treated timber at present prices ranging from 2*s*. to 2*s*. 5*d*. per cubic foot according to locality. Different kinds of timber absorb varying amounts of creosote.

MESSRS. ARMSTRONG ADDISON AND CO., of Sunderland, state that the cost of creosoting depends on the quantity of oil injected, but may be put at from 4½*d*. to 5*d*. per cubic foot; and that "kyanising," which is usually employed when wood has to be painted, or where there is special danger of fire, costs from 9*d*. to 10*d*. per cubic foot; they add that the cost of the process which they employ (an alternative process to either creosoting or kyanising, in which metallic salts in solution are used instead of creosote, and the liquid is forced into the timber under pressure) is only slightly more than that of creosoting, and as the salts are fire-resisting the process is very usefully employed for estate or farm purposes.

Mr. W. B. HAVELOCK, a great authority on the subject of creosoting home-grown timber, whose experience in this connection has extended over a period of eighteen years, stated that the present price of creosote such as he uses delivered to his station was 4¼*d* per gallon,* plus the carriage of the empty casks, which practically added another farthing to the cost. As the prices of creosote had risen recently, the estimate that creosoting under pressure now costs from 4*d*. to 6*d*. per cubic foot was not an unreasonable one.—JOURNAL OF THE BOARD OF AGRICULTURE.

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* A gallon of creosote oil weighs about 10½ lb.

THE WORLD'S CANE-SUGAR INDUSTRY.

In the course of his review of "The World's Cane-Sugar Industry Past and Present" by H. C. Prinsen Geerligs, Mr. G. Clarke, F.I.C., Agricultural Chemist to the Government of the United Provinces, says that the production was distributed amongst the more important cane-producing countries in 1910 as follows :—

India	...	2,125,000	Mauritius	...	252,000
Cuba	...	1,804,000	Formosa and Japan	...	270,000
Java	...	1,278,000	West Indies	...	282,000
South America and Mexico	...	708,000	Australia	...	148,000
Hawaii	...	463,000	Demerara	...	115,000
United States	...	335,000	Philippines	...	112,000
Porto Rico	...	305,000	Egypt	...	59,000

and yet further in his review Mr. Clarke observes that the most valuable and interesting information from different countries is given on the following points :—

(i) The price of cane.

(ii) The outturn of sugar per 100 cane.

(iii) The yield of sugar per acre.

Some of these results have been selected, and summarised in the following table :—

Country.	Price of cane delivered at factory, annas per maund.	Yield of sugar per 100 cane (Basis 96 Polar).	Sucrose per 100 cane.	Yield of raw sugar per acre in maunds
Cuba	4·4	11·62	12·13	53·5
Hawaii	5·8	12·50	15·8—17·8	127·5
Australia	6·0	10·95	12·13	51·6
Brazil	4—6·5	9·0 (5-—6 open pan)	15·0	54·4
Egypt	5·5	10·71	12·73	58·0
Barbados	...	7·5 (Muscovado)	13·5	...
Trinidad	...	8·94	12·5	...
British Guiana	3·0	8·4	11·5	...

It will be noticed that the price of cane in Cuba is not high in spite of the scarcity of labour. This is accounted for by the fact that cane, when once planted, yields a large number of ratoon crops (five or even more)

The price in Hawaii is high due to labour difficulties, which seem to be more prominent here than in most countries. Indentured labour is of course forbidden by the United States, and white labour finds it hard to stand the strain of field work under tropical conditions. Everything has been tried; Portuguese, Japanese, Russians from Vladivostock—but the labour question is still the limiting factor in Hawaiian production.

The scarcity and high price of labour is compensated, to some extent, by the high outturn of sugar per acre, and the efficiency with which the factories are worked. The sugar content of the bagasse is reduced to 3 per cent., and the extraction of sugar reaches 95 per cent. This result is produced by maceration to an extent which would not be profitable in a country like India, where labour is plentiful and fuel scarce. The yield of raw sugar per acre in Hawaii also exceeds that of any other country. The average for 1910 over the whole island was over $4\frac{1}{2}$ tons; while on selected estates it was as high as 8·8 tons. Careful attention is given to cultivation and the selection of suitable varieties, and the cane fields are intensely manured. The amount spent on artificial manures (Sulphate of Ammonia, Saltpetre, Potash and Superphosphate) is given as Rs. 60 per acre.—AGRICULTURAL JOURNAL OF INDIA.

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ON WATERING.

The experienced gardener knows as it were by instinct when to give and when to withhold water; but to the intelligent beginner watering presents many puzzling problems. Some of these problems may be solved by common sense aided by a knowledge of plants and their habits; others are more intricate, and may be resolved only by long and close study of the peculiari ties of plants.

Apart, however, from special cases, it is possible to lay down certain general rules for the guidance of beginners, and although a knowledge of these rules will by no means prevent the amateur from making mistakes, it may help him to discover his mistakes, and thus to avoid repeating them.

In order to be in a position to lay down rules—to sketch in outline a philosophy of watering—we must know something about the water requirements of the plant, and we must have a clear idea as to the nature of the reservoir—the soil—in which is stored the water absorbed by plants. For the sake of conciseness we will state the main facts with respect to the water requirements of plants in categorical fashion:—

First, it is to be observed that plants consist mainly of water. In a dry seed such as a pea there is about 10 per cent., and in a lettuce leaf something like 85-90 per cent. of water. There are other yet more watery vegetables —certain gelatinous algæ, for example, consist of no less than 99 per cent. of water.

Second, a plant utilises for one purpose or another and during its growing period an amount of water many times greater than its own bulk. How great is this amount may be gauged by the fact that mangels, which are thirsty plants, give off from their leaves a quantity of water equal to about half the amount of rain which falls during a year on the field on which they are growing. This stream of water, which passes through the plant, comes from the soil and escapes as vapour from the leaves. In that stream the mineral substances—essential to the building up of the living material—are carried to the leaves, and by the evaporation of the water from the leaf and other surfaces the temperature of the plant is regulated.

Third, the roots of a plant require not only water, but air, and therefore a constantly saturated soil is fatal to the health of nearly all plants. Wherefore it follows that if water fills completely the interstices of the soil the plant cannot flourish. From this we may infer that the plant growing in properly cultivated soil obtains its water not from minute liquid masses lying in the spaces between the soil-particles, but from the water-films which surround and adhere to those particles. These films are attached or stuck to the particles by surface tension, and the thinner the water film the tighter it sticks to the grain of soil. Hence before a soil is itself dry there comes a time when it refuses to yield up any more water to the plant, and the latter may begin to wilt whilst there is yet a considerable amount of water in the soil. The power of holding water by surface tension varies according to the nature of the soil; sands with their big particles have the power less than clays with their excessively minute soil particles.

Fourth, and speaking generally, there is a relation between amount of water and state of the plant. The nature of this relation may be judged from the fact that it is possible to prevent plants from flowering, whilst maintaining them in healthy vegetative growth by supplying them continuously with plenty of water. Indeed, it might be said that every plant requires a longer or shorter period of rest between its growing vegetative period and its flowering period, and that during this rest period it requires to be kept drier than at other times. Sometimes, as in epiphytic and certain other orchids, the resting period is well marked, and during that period, as is well known, water must be given sparingly, if at all. Sometimes the transition between vegetative and flowering stage is so slight as to be unnoticed or even unnoticeable. It follows therefore that when water is given to ordinary actively growing garden subjects plenty must be given, for in the first place the plant requires much water, and in the second place much that is given is bound to drain away: yet after the watering each of the countless soil particles which make up the soil should be surrounded by as thick a water film as it can hold. An actual example will serve to illustrate not only the slight effect of light watering and the big effect of thorough watering, but also the fact that a too copious and frequent watering is useless, and indeed often harmful. The example consists of an experiment carried out by M. A. Petit, Professor of the French National School of Horticulture. A crop of lettuces was divided into plots of 1-40th acre each, which were watered at intervals 13 times, and each time with a known amount of water. The results were as follows:—

Plot.	Amount of water (galls.) Per watering.	Total.	Yield in lb.
1	0	0	316
2	51	663	326
3	102	1,326	369
4	153	1,989	390
5	204	2,552	360

As the numbers show, the light watering received by Plot 2 made practically no difference to the yield, double the quantity (Plot 3) increased the crop by about 15 per cent. three times the amount of water (Plot 4) caused a yet greater yield, whereas further increase actually reduced the size of the crop. This general rule admits of exceptions, of course, but it is not our present task to deal with the difficult plants; but rather with the common sense of watering.

It might at first sight seem a matter of indifference at what time of the day watering is done, and yet there is a well established prejudice against watering in the middle of a bright sunny day. As so often happens, science, at first nonplussed by and sceptical of practical experience, contrives subsequently to discover the reason for the practice. In the present instance the explanation is extremely curious, and shows incidentally what a remarkably complicated thing is the soil. From the investigations of German men of science it appears that when water is added to dry earth a considerable quantity of heat is disengaged. This is specially marked in the case of soils

rich in clay, and particularly in clays containing a large proportion of organic matter; in short, the heat produced by the addition of water to soil will be greatest in the best garden soils. If therefore water be added to a soil dried and baked by the sun, the temperature of the soil, already high, is raised yet more, and may well bring about serious damage to the roots. M. Petit finds that the rise of temperature brought about by watering a dry rich garden soil may amount to so much as 20° F. With plants under glass the gardener has, of course, another way of controlling the water content of the plant, and that is by regulating the amount of water in the atmosphere and by syringing the foliage. The effect of increasing the humidity of the air is, of course, to reduce the amount of water given off by the leaves; the physiological effect of syringing is more complicated, and must be considered on another occasion.

TAPPING EXPERIMENTS ON CEARA.

(*Manihot Glaziovii*).

The following notes on Ceara tapping are taken from a recent pamphlet by Dr. P. Arens, of the Experiment Station, Malang, Java.

TAPPING SYSTEMS.

The "Lewa" system is generally employed in German East Africa. After wetting a part of the stem with the coagulant (dilute acetic acid or a solution of Calcium Chloride), a number of incisions about 1 cm. in length are made with the end of a knife. The exuding latex coagulates on the stem, and is collected as scrap. The incisions are made along a vertical strip, or on rectangular areas distributed over the stem and the larger branches. The trees are tapped twice a month, a fresh area of the stem being treated each time. The yield per tree per tapping is from three to four grams, or about 80 to 100 grams per year from four year old trees. On the other hand, the cost of the coagulaut works out at 16 to 40 cents per kilogram of rubber, according to Sandemann, or 6 to 18 cents, according to Zimmerman. The total cost of a kilogramme of dry rubber is f 3·60 landed at Hamburg (*fide* Warnholz) or f 2·40 on the estate (Sandemann). The great disadvantage of this method is that the product is scrap rubber only.

Sandemann has introduced into Africa the Bamber system. A shallow vertical groove is made in the cortex, and short horizontal incisions are made along the groove by means of a four-bladed "pricker" and a mallet. At the next tapping another vertical groove is made at a distance of one centimetre from the first, and this process is continued until the tree has been tapped all round. New grooves are then made between the old ones. The latex is collected in a cup at the base of the vertical groove.

A third method, known as the Zuidergebergte method, has been employed at Malang. A vertical incision is made, extending right through the cortex to the cambium along the whole length of the stem, and the latex is collected in a cup at the base. At the next tapping, a similar vertical incision is made, one inch from the first, and so on round the tree. (This system was employed in Ceylon in 1883. T.P.).

Experiments have also been carried out at Malang with the systems employed on Hevea, a modified Burgess knife being used.

AT WHAT AGE MAY CEARA BE TAPPED.

In the case of closely planted trees which are to be thinned out, some may be tapped at the age of two years. Permanent trees should not be tapped until four years old. Before that age, the cortex is generally so thin that injury cannot be avoided. Trees which measure 40 to 50 centimetres in circumference at a height of one metre may be regarded as tappable, provided that the latex is sufficiently concentrated.

STRIPPING THE STEM.

It is customary, in the case of Ceara, to remove the outer bark before tapping. That practice involves some risk. Since the outer bark protects the soft laticiferous cortex from injury and from drying up, there is the danger, in an open plantation where the sun strikes the stems, that the cortex will dry up in large patches, especially if the outer bark is removed in the dry season. On the other hand, in the wet season, the outer bark appears to be more firmly attached to the inner cortex, and if it is stripped off, then the inner cortex may be torn away from the wood, with the result that rubber pads are formed between the wood and the cortex, and the cortex overlying them subsequently decays. Stripping is best done at the beginning of the dry season provided that the trees are then in full leaf. The whole of the stem should not be stripped, but only so much as is required for the next one or two month's tapping. In consequence of this removal of the outer bark, the outer layers of the inner cortex dry up, and the yield of latex is thereby diminished for the next few days : it is better, therefore, to take off the outer bark about two weeks before tapping is begun.

PRELIMINARY EXPERIMENTS WITH THE BAMBER-SANDEMANN SYSTEM.

Four groups of three-and-a-half-year old trees, each containing ten trees, were tapped on this system, the average circumference of the trees being 48 centimetres. Group A was tapped every day, Group B every other day, Group C every third day, and Group D once a week. The outer bark was removed in all cases. The trees were tapped from November 2nd to January 12th. The results show no advantage in the longer interval, the average yield per tree per tapping being about 2 grammes in each case. In Group A, the second round of the trees, i. e., the cuts between the previous vertical ones, was begun on December 8th, and the yield from these intermediate cuts was so small that it was thought advisable to rest the trees until January 2nd ; that however did not improve the subsequent daily yields.

COMPARATIVE EXPERIMENTS WITH DIFFERENT SYSTEMS.

Eight groups of trees were selected, each containing ten trees of an average circumference of 66 centimetres. Group 1 was tapped with the Bamber pricker ; Group 2 by the Zuidergebergte system, the vertical incisions being one inch apart ; Group 3 by the same system but with a rotating pricker instead of a knife ; Group 4 by a half herring bone with three cuts, 18 inches apart, on one third of the circumference, the cuts being renewed daily ; Group 5 by the same system, but leaving narrow strips of cortex intact between the daily cuts ; and Group 6 by the herring bone, but with knife and pricker. All the trees were tapped daily.

ZUIDERGEBERGTE SYSTEM, GROUPS 2 AND 3. The pricker was tried because the incisions made with the knife opened widely and produced broad wounds, but it was found that the pieces of cortex between the pricker cuts ultimately split, and consequently the final effect was the same. The yield per tree per tapping in each of these groups was small, about 1·2 grams per tapping (25 tappings), and it fell off considerably as soon as the new cuts were made between the old ones.

BAMBER-SANDEMANN SYSTEM, GROUP 1. This group was tapped for three months. The average yield per tree per tapping for the first ten tappings was 3·06 grams, in the middle of the tapping period 2·12 grams, and for the last ten tappings, 1·6 grams. The yield was high at the beginning, so that fewer tappings would be required than in other systems, to produce a given quantity of rubber. But owing to great number of incisions, the trees could not be tapped by this method for more than four months and they require nine months' rest before they are fit for tapping again. Consequently the number of tappings possible in the course of a year is not great. Further disadvantages are that a cooly can tap only twenty trees in an hour, and that the system involves great damage to the roots by the interruption of their food supply.

HALF HERRING BONE, GROUPS 4-6. In Group 4, the average yields per tree per tapping, over the same periods as those quoted for group 3, were 1·68 grams, 1·46 grams and 1·93 grams. These are less than those obtained by the Bamber-Sandemann system, but on the other hand a cooly can tap 200 trees a day, the yield does not fall off so rapidly, and the interference with the functions of the tree is less. The yield in group 5 was very small and the consumption of bark four or five times as great as in group 4; that part of the experiment was therefore soon abandoned. Similarly, the use of the pricker in group 6 did not increase the yield.

Dr. Arens concludes that, of the systems under experiment, the ordinary method employed in Hevea is the best for Ceara, but the vertical channel is unnecessary. He supports his conclusion by the results of three months tapping on 1,000 three to five year old trees on Rini Estate. These trees were tapped daily by three cuts, eighteen inches apart, on the half herring bone plan but without a vertical channel, on one third of the circumference. Before tapping, strips of outer bark about ten centimetres wide were removed along the line of each tapping cut. From December 27th to February 25th, the average yield of dry rubber per tree per tapping was 1·68 grams. On February 25th, the system of payment was changed, and the yield from February 26th to March 30th fell in consequence to 1·31 grams. For the whole tapping period the average yield per tree per tapping was 1·54 grams, (=4½ ounces per tree in 3 months).

TAPPING KNIVES.

The knife used in these experiments was a modification of the Burgess knife, the angle between the cutting edges being made smaller. The results on Rini Estate were obtained with a knife invented by Herr Krijthe and Dr. Vriens. In the Zuidergebergte, good tapping has been done with a small Jebong knife.

INFLUENCE OF THE NUMBER OF TAPPING CUTS ON THE YIELD.

Ten trees were tapped on the half herring bone system with four cuts, 30 centimetres apart, the lowest cut being 40 centimetres from the ground. The trees were first tapped on all four cuts for a week. In the second week, two cuts only, Nos. 2 and 4, counting from the top, were tapped; in the third week, all four cuts; in the fourth week, Nos. 1 and 3 only. Four more cuts were then put on each tree between the former, so that they now stood at 15 centimetres apart, and the trees were tapped on all the eight cuts for another week. The results of these tappings were—2 cuts (Nos. 2 and 4) yielded 28·29 grams; 4 cuts yielded 52·41 grams; 2 cuts (Nos. 1 and 3) yielded 23·57 grams; and 8 cuts yielded 74·83 grams. Thus, during the short period of the experiment, four cuts at 30 centimetres gave practically twice as much as two cuts at 30 centimetres apart; but eight cuts at 15 centimetres apart did not give double the yield of four cuts at 30 centimetres.

YIELD AT DIFFERENT HEIGHTS.

Ten trees were tapped daily, each by three cuts, one at 40 centimetres, another at 120 centimetres and the third at 2 metres from the ground. All the cuts were fifteen centimetres long. The yield, in about six weeks tapping was 143·73 grams from the lowest cuts, 106·42 from the intermediate, and 103·67 from the highest.

INFLUENCE OF LENGTH OF THE CUT ON THE YIELD.

Ten trees were tapped with two cuts, each 15 centimetres long, at heights of 50 centimetres and 1 metre respectively from the ground. In three weeks (daily tapping) the yield was 83·46 grams. The cuts were then lengthened to 30 centimetres, and tapping was continued for another three weeks, the yield being 141·32 grams. Thus the long cuts did not yield twice as much as the short. (The influence of the previous tapping and possibly variation in climatic conditions has to be considered).

On another group of ten trees, long cuts (30 cm.) and short cuts (15 cm.) were made on the same trees. On five trees, the long cuts were made below a height of 50 centimetres, and the short cuts above 1 metre; while on the other five the positions were reversed. In six weeks' daily tapping, the long cuts yielded 174·23 grams, and the short cuts, 111·44 grams. This confirms the previous result.

BARK RENEWAL.

With good tapping, bark renewal on Ceara takes place much more rapidly than on Hevea. In the case of trees tapped by the herring bone system, the renewed cortex one year after tapping is as thick as the original cortex and yields latex abundantly. Three years is sufficient to allow for bark renewal.

(It may be pointed out that there is no evidence in the pamphlet that any trees have been subjected to *continuous* tapping for more than three months).

T. PETCH.

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ALOES, Socotrine cwt.	Fair to fine	45/6 a 55/
Zanzibar& Hepatic "	Common to good	40/ a 65/
ARROWROOT (Natal) lb.	Fair to fine	8d a 9d
BEES' WAX cwt.		
Zanzibar Yellow "	Slightly drossy to fair	£7 7/6 a £7 10/
East Indian, bleached "	Fair to good	£8 10/a £8 12/6
" unbleached "	Dark to good genuine	£6 5/ a £6 15/
" Madagascar "	Dark to good palish	£7 10/a £7 15/
CAMPHOR, Japan lb.	Refined	1/ 4½ a 1/6
China cwt.	Fair average quality	155/
CARDAMOMS, Tuticorin	Good to fine bold	4/9 a 5/3
per lb.	Middling lean	4/1 a 4/6
Malabar, Tellicherry "	Good to fine bold	4/8 a 5/2
Calicut "	Brownish	4/1 a 4/6
Mangalore "	Med Brown to good bold	4/4 a 5/10
Ceylon, Mysore "	Small fair to fine plump	3/3 a 5/3
Malabar "	Fair to good	3/3 a 3/4
Seeds, E. I. & Ceylon "	Fair to good	3/10 a 4/
Ceylon "Long Wild" "	Shelly to good	1/2 a 3/2
CASTOR OIL, Calcutta "	Good 2nds	3¼ d
CHILLIES, Zanzibar cwt.	Dull to fine bright	37/6 a 45/
Japan "	Fair bright small	28/ a 32/6
CINCHONA BARK.—lb.	Crown, Renewed	3⅜ d a 7 d
Ceylon	Org. Stem	2d a 6d
	Red Org. Stem	1¾ d a 4½d
	Renewed	3d a 5½d
	Root	1⅝d a 4d
CINNAMON, Ceylon 1sts.	Good to fine quill	1/3 a 1/7
per lb. 2nds.	" "	1/3 a 1/6
3rds.	" "	1/1 a 1/5
4ths.	" "	1/ a 1/3
Chips, &c.,	Fair to fine bold	2d a 4d
CLOVES, Penang lb.	Dull to fine bright pkd.	11d a 1/1
Amboyna ...	Dull to fine	10d a 10½d
Zanzibar ...	Fair and fine bright	7½d a 8¾d
Madagascar ...	Fair	7¼d
Stems ...	Fair	2½d
COFFEE		
Ceylon Plantation cwt.	Medium to bold	Nominal
Native	Good ordinary	Nominal
Liberian "	Fair to bold	74/a 82/
COCOA, Ceylon Plant, "	Special Marks	86/ a 95/
	Red to good	81/ a 85/
Native Estate "	Ordinary to red	42/ a 78/6
Java and Celebes "	Small to good red	30s a 96s
COLOMBO ROOT "	Middling to good	12/ a 19/6
CROTON SEEDS, sift. "	Dull to fair	45/ a 50/
CUBEBS "	Ord. stalky to good	140/ a 170
GINGER, Bengal, rough "	Fair	30/ nom.
Calicut, Cut A "	Medium to fine bold	60/ a 75
B & C "	Small and medium	36/ a 60/
Cochin, Rough "	Common to fine bold	27/ a 30/
	Small and D's	27/6
Japan "	Unsplit	21/
GUM AMMONIACUM "	Ord. Blocky to fair clean	40s a 72s 6d
ANIMI, Zanzibar	Pale and amber, ster. srts	£12 10/ a £14 5/
"	" little red	£11 a £12
"	Bean and Pea size ditto	70/ a £9
"	Fair to good red sorts	£7 a £10
"	Med. and bold glassy sorts	£5 a £7 10/
Madagascar "	Fair to good palish	£4 a £8
" " red		£4 a £7
ARABIC E. I. & Aden "	Ordinary to good pale	28/ a 32/ nom
Turkey sorts "		32/6 a 55/
Ghatti "	Sorts to fine pale	18/6 a 32/6nom
Kurrachee "	Reddish to good pale	25 a 30s nom
Madras "	Dark to fine pale	22/6 a 29/6nom
ASSAFŒTIDA "	Clean fr. to gd. almonds	£7 a £8
	com. stony to good block	40s a £5 12/6
KINO lb.	Fair to fine bright	6d a 1/5
MYRRH, Aden sorts cwt.	Middling to good	50/ a 62/6
Somali "	" "	42s 6d a 45s
OLIBANUM, drop "	Good to fine white	45s a 50s
"	Middling to fair	35s a 40s
pickings "	Low to good pale	15/ a 27/6
siftings "	Slightly foul to fine	20s a 22s 6d
INDIA RUBBER lb.	Fine Para bis. & sheets	2/9
	" Ceara " "	2/7
Ceylon, Straits, Malay Straits, etc.	Crepe ordinary to fine	2/9 a 2/9½
	Fine Block	2/9
	Scrap fair to fine	2/
Assam	Plantation	2/2
	Fair 11 to ord. red No. 1.	1/6 a 1/9
Rangoon	" " "	1/5 a 1/8

	QUALITY.	QUOTATIONS.
INDIARUBBER lb.		
Borneo "	Common to good	1/ a 1/6
Java "	Good to fine red	1/6 a 1/7
Penang "	Low white to prime red	9 d a 1/7
Mozambique "	Fair to fine red ball	2/2 a 2/6
"	Sausage, fair to good	2/ a 2/ 4
"	Fair to fine ball	2/ a 2/3
Nyassaland "	Fr. to fine pinky & white	1/8 a 1/10
Madagascar "	Majunga & blk coated	1/ a 1/4
"	Niggers, low to good	6d a 1/6
"	Ordinary to fine ball	1/6 a 1/8
New Guinea "	Shipping mid to gd. violet	3s a 3s 6d
INDIGO, E.I. Bengal "	Consuming mid. to gd.	2s 3d a 2s 10d
"	Ordinary to middling	2s a 2s 2d
"	Mid. to good Kurpah	1s 10d a 2s 5d
"	Low to ordinary	1s 6d a 1s 9d
"	Mid. to fine Madras	None here
MACE, Bombay & Penang	Pale reddish to fine	2/6 a 2/8
per lb.	Ordinary to fair	2/2 a 2/4
Java	" good pale	2/4 a 2/8
Bombay	Wild	10d a 1
NUTMEGS,— lb.		
Singapore & Penang "	64's 57 s	9½d a 10½d
	80's	7d
	110's	6½d
	160's to 115's	6d
NUTS, ARECA cwt.	Ordinary to fair fresh	17/6 a 20/
NUX VOMICA, Cochin	Ordinary to good	9/6 a 12/
per cwt. Bengal	" "	8/9
Madras	" "	8/6 a 9/6
OIL OF ANISEED lb.	Fair merchantable	7/
CASSIA "	According to analysis	3/2 a 3/7
LEMONGRASS oz.	Good flavour & colour	3d
NUTMEG "	Dingy to white	1½d a 1⅝d
CINNAMON "	Ordinary to fair sweet	2½d a 1s 5d
CITRONELLA lb.	Bright & good flavour	1/8½
ORCHELLA WEED—cwt		
Ceylon "	Fair	10/ Nom.
Madagascar "	Fair	10/ "
Zanzibar "	Fair	10/ "
PEPPER—(Black) lb.		
Alleppy & Tellicherry	Fair	5⅛d a 5½d
Ceylon " "	Fair to fine bold heavy	5½d a 5¾d
Singapore ...	Fair	5⅜d
Acheen & W. C. Penang	Dull to fine	5d a 5½d
(White) Singapore "	Fair to fine	8¾d a 9d
Siam "	Fair	8¾d
Penang "	Fair	8d
Muntok "	Fair	9¼d
RHUBARB, Shenzi lb.	Ordinary to good	3/6 a 4/6
Canton "	Ordinary to good	3/ a 4/
High Dried,,	Fair to fine flat	1/ a 1/2
	Dark to fair round	10d a 1/
SAGO, PEARL, large--cwt	Fair to fine	18/
medium ...	" "	17/
small ...	" "	13/ a 15/
Flour ..	Good pinky to white	11/ a 12/
SEEDLAC cwt.	Ordinary to gd. soluble	65/ a 85/
SENNA, Tinnevelly lb.	Good to fine bold green	4½d a 8½d
	Fair greenish	2½ d a 4d
	Common specky & small	1d a 2¼d
SHELLS, M. o' PEARL—	Small to bold	82/6 a £ 9 10/
Egyptian cwt.	" "	70/ a £9 2/6
Bombay "	Chicken to bold	10 17/6 a 14 2/6
Mergui "	Fair to good	£9 5/ a £14 10/
Manilla "	Sorts	70/ a 90/
Banda "	Small to large	55/ a 92/6
Green Snail "	Trimmed selected small	
Japan Ear "	to bold	72/6 a £9
TAMARINDS, Calcutta...	Mid to fine bl'k not stony	12/ a 13
per cwt. Madras	Inferior to good	6/ a 10/
TORTOISESHELL—		
Zanzibar, & Bombay lb.	Small to bold	13/ a 34/
	Pickings	13/ a 21/
TURMERIC, Bengal cwt.	Fair	16/
Madras "	Finger fair to fine bold	16/
Do. "	Bulbs " " [bright	13/ a 14/6
Cochin "	Finger fair	16/
	Bulbs "	14/
VANILLOES— lb.		
Mauritius ... } 1sts.	Gd. crystallized 3½a 8½a in.	11/6 a 16/
Madagascar ... } 2nds.	Foxy & reddish 3½a "	11/ a 12/6
Seychelles ... } 3rds.	Lean and inferior	11/ a 11/6
VERMILLION ...	Fine, pure bright	2/9
WAX, Japan, squares	Good white hard	44/

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JETHRO TULL.

Born 1674; died 1741. His methods of soil tillage lie at the foundation of the modern system of dry farming.